January 2001
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MODEL Airplane NEWS

JANUARY 2001 • VOLUME 129, NUMBER 1

ON THE COVER: this beautiful portrait of a Grumman F4F-4 Wildcat was painted by the late Jo Kotula and graced the cover of a previous issue of *Model Airplane News*. If you know the issue in which this painting first appeared, mail your answer to: Jo Kotula cover, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Email entries are not valid. We will draw five names out of the first 50 correct answers and give away free, one-year subscriptions or renewals.

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From classics to contrails

Our January issue features a bonus, photo-illustrated guide to 350 favorite *Model Airplane News* full-size plans, and this year, we've included many more vintage free-flight designs that would be great subjects to convert to RC with micro gear. Whether you're looking for a scale-competition warbird or a backyard barnstormer, you're sure to find a winter building project here. For the complete selection of *Model Airplane News* plans, visit the RC Store at www.rcstore.com.

Contributor John Jundt and editor Gerry Yarrish teamed up to cover the 10th annual Heart of Ohio Jet Scramble, where nearly 6,000 spectators were treated to a three-day show of some of the hottest, fastest RC models around. Turbines powered 40 percent of the 118 entries at the rally, emphasizing the role that this technology is playing in the development of RC modeling. On the lighter side, Thayer Syme writes about a recent Lazy-Bee Fly-In, where a "swarm" of Bees in all shapes and sizes showcased their surprising capabilities with an emphasis on fun. Andy Clancy's creative designs appeal to the kid in all of us: they're fun to build, easy to fly and lend themselves to a myriad of modifications and personal touches. For a story that's guaranteed to make you chuckle, turn to page 146.

For years, sport fliers have enjoyed the clean, quiet, vibration-free advantages of electric power. Now, scale modelers are asking how they can use e-power in their competition models. Scale competitor Bob Benjamin, who has successfully competed with electric models at prestigious events such as the Scale Masters and Top Gun, offers some insight on which airplanes are the best subjects for e-power and how to best take advantage of this reliable power source. See his tips for success on page 78.

Featured as construction articles this month, the Mini Kaos and Airfoiler are proof of the enduring appeal of vintage designs. Dave Robelen's Mini Kaos is a ½A sport pattern ship based on Joe Bridi's popular Kaos model of the 1970s. Though smaller, Dave's design retains many of the outstanding flight characteristics of the original. An RC-assist model, the Airfoiler is legal for Society of Antique Modelers meets and is based on Hal deBolt's original 1940s free-flight plane. A regular contributor to *Model Airplane News* for more than half a century, Hal deBolt is recognized as an icon of the industry and the hobby. We're especially pleased to have his construction article in this first issue of the new century.

Charlie Lyons flew this Yellow Aircraft F-14 Super Tomcat at the Ohio Jet Scramble (photo by Gerry Yarrish).

MODEL Airplane NEWS
FOUNDED 1929

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PRINTED IN THE USA

AIRWAVES

Our readers write back

WRITE TO US! We welcome your comments and suggestions. Letters should be addressed to "Airwaves," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; man@airage.com. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous number of letters we receive, we can not respond to every one.

MEASURING ENGINE TEMPERATURE

I read Dave Gierke's column in the November 2000 issue about 4-cycling and found it most informative. More articles like this would be welcome. You mentioned head temp measurement. I am a beginner and have had a lot of trouble adjusting 2-stroke-engine needle valves. There was an article in another magazine about using a non-contact temp gauge to measure head temp and using this measurement to set the needle valve for correct engine operation. The temperature was around 210 to 230 degrees F. I find head temp to be anywhere from 190 to 255 degrees F, depending on where along the head the measurement is taken. The rear just above the crankcase seems to be the hottest. I concluded that using the head temp to set needle valves is touchy, at best. Any ideas or information you can add would be greatly appreciated. Thank you for your time. [email]

P. HARVEY

I also read that business of using an infrared gun to measure the head temperature and set the needle valve. I also have one of these but find it inaccurate. The manufacturer states that it shouldn't be used on shiny surfaces such as a cylinder head. For my dynamometer work, I use a calibrated thermocouple. I use this only as a reference for when to take torque and rpm readings, as performance will vary greatly if you take data when the engine is cold or too hot. I use an EGT (exhaust gas temperature) thermocouple to set the needle when I'm doing economy tests to determine specific fuel consumption (sfc). This relates to the mass of fuel consumed for the amount of bhp being produced over a period of time.

For all practical purposes, the needle can be set very nicely by using a tachometer. Simply needle the engine to its approximate maximum rpm; then give the fuel-feed line a momentary pinch. If rpm increase, lean the needle a bit more. Keep doing this until no further increase is noted on the tach. This is the engine's max rpm for the propeller load you are using. Next, the needle should be backed off several hundred rpm. Now the engine is ready for flight. Listen to the exhaust note, since you don't want it to run lean in the air. By modifying the needle a couple of clicks at a time, you can arrive at an acceptable setting. Good luck with your engines!

DAVE GIERKE

GAS OR GLOW?

I've been a modeler for several years and am now thinking about buying a giant-scale model. I want to build the new Dynaflite DHC-1 Chipmunk but am having difficulty deciding on the type of engine to power the model—gasoline or glow power. A friend who swears by glow power suggested that I use a Super Tigre 3000, while another friend says I should get a Saito 1.80 4-stroke. The guy at the hobby shop suggested a U.S. Engines 25cc gas engine. There are so many combinations; what is your suggestion?

JOHN SULLIVAN
Groton, CT

AIR WAVES

John, I do agree that at times, there seem to be more solutions to any given problem than are needed, but when it comes to powering a model, especially a giant size, you should be comfortable with the choices. First, you should base your decision on your experience with model engines. If you've had a good time with 4-strokes and are comfortable adjusting them, then that's what you should use. If the simplicity of a big glow engine feels safe, go for it. I enjoy running gasoline engines, so that's what I'd choose.

You also need to evaluate the model itself. When thinking about suitable powerplants for a model, I look at the type of model (high wing or low wing), and I figure out the wing area/loading. This helps me determine how heavy the model can be and still fly well. The new Dynaflite Chipmunk is advertised as weighing 14 to 18 pounds, and it has a wing area of 1,189 square inches. That's a low wing loading of 27.15 ounces per square foot and a high of 34.90 ounces per square foot. If we shot for the average weight and wing loading, then we could say this is a 30-ounce-per-square-foot model.

Gas engines are relatively heavy when compared with glow engines, so in this case, even though I love the gas burners, I'd go with a 1.20 or 1.50 4-stroke engine for a better power-to-weight ratio.

With a little more area or a little less weight, a 30- to 40cc gas engine would be my next choice. Remember that if you choose a large-displacement glow engine, you'll also have to carry a larger than normal fuel tank to feed it. I hope this helps you decide what's right for you.

GY

New products or people behind the scenes: my sources have been put on alert to get the scoop! In this column, you'll find new things that will at times cause consternation, and telepathic insults will probably be launched in my general direction! But who cares? It's you, the reader, who matters most! I spy for those who fly!

AIR SCOOP

BY CHRIS CHIANELLI

DELTA FORCE

Well-known British manufacturer Balsacraft has unveiled its super-sleek Rapier—a delta-wing design for intermediate fliers that uses large control surfaces for quick response and maneuverability. As are all Balsacraft kits, the Rapier is constructed of competition-grade balsa and is fully sheeted for strength and enhanced finish quality. The plywood parts are CNC precision-routed, and the plans are CAD-drawn. Interlocking construction and clearly labeled wood parts are featured and take the guesswork out of assembly. Specifications: wingspan—45.6 inches; power—2-stroke .40 to .48ci; radio required—3- to 6-channel.

Great Planes Model Distributors, P.O. Box 9021, Champaign, IL 61826-9021; (217) 398-6300.

JR XF631

6-channel simplicity

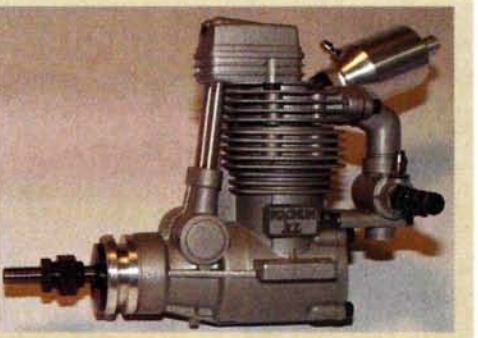
Easy operation was a prime design directive with JR's all new JR XF631; the only programming functions it has are the ones used most by modelers, such as dual rates, travel adjustments and subtrims. The XF631 also offers 3-model memory and is preprogrammed with three types of wing mixes (standard, flapperon, or delta/elevon). The programming switches are conveniently placed below the main power switch within easy reach for better control. JR provides everything you need in a flight pack. The XF631's flight pack includes the new, lighter, narrower R700 receiver and four of JR's new S537 standard BB servos, which have ⅓ the deadband of the S517 for improved accuracy. Don't like to mess around with more complicated 6-channel radios? You'll have more fun—and more flying time—with JR's XF631.

Also shown, and available separately, is the new JR R700 Slimline FM receiver that has one more channel than the R600 yet is slimmer in design and weighs about 1 ounce. As with all JR FM receivers, the R700 features the excellent interference protection of JR's patented ABC&W circuitry. The R700 is compatible with any current JR FM aircraft system and will be the standard receiver included with new JR FM systems.

JR; distributed exclusively by Horizon Hobby, 4105 Fieldstone Rd., Champaign, IL 61822; (217) 355-9511.

Two new engines from Magnum

Magnum has taken its XL-52RFS and bored it out to a .61 displacement. The new XL-61RFS offers the same compact size as the 52 but simply adds more prop-twisting power and is capable of turning larger props than the XL-.52 with no weight gain. Of course, idle was not sacrificed. Rumor has it that the price of the XL-61 will be similar to that of the 52.



Here's another bit of info that is *not* a rumor. The new 46cc gas/ignition engine is Magnum's first step into the large-scale engine market. The 46cc is still in prototype form but will feature an industrial carb, electronic ignition (included) and even adjustable, advance spark-ignition timing. Expect it to be out by early 2001.

Global Hobby Distributors, 18480 Bandilier Cir., Fountain Valley, CA 92728-8610; (714) 963-0133; fax (714) 962-6452.

RD6000 Sport

The easy-to-use RD6000 Sport 6-channel PPM/FM system was designed with basic features to help you get started in computer radios. The RD6000 Sport comes with an array of standard features such as 4-model memory, digital trims, LCD display, throttle cut switch, trainer system, helicopter, airplane and sailplane software, PPM/FM modulation, hover pitch and hover throttle trim adjusters and slimline micro dual-conversion 7-channel FM receiver, and it's available with a variety of servo combinations.

Airtronics, 1185 Stanford Ct., Anaheim, CA 92805; (714) 978-1895; fax (714) 978-1540; www.airtronics.net.

Giant Skymaster

You'll never be apprehensive about engine flame-out on a scale twin when the scale subject is a Skymaster. This is Aviomodelli's new 7-foot-wingspan Cessna 02 Skymaster. With a laser-cut balsa-and-plywood fuselage, center-section and tail-boom construction, this model features wings and tail surfaces that are balsa-covered foam with a gelcoat. The kit's accessories include aluminum main gear, two Duraflex cowls, interior, wheels, fuel tanks, spinners and decals for the U.S. Air Force version that was flown in Vietnam. Specs: wingspan—87 inches; length—46 inches (not including tail booms); weight—12 to 14 pounds; engine requirements—two .45 2-strokes or .70 4-strokes.

Hi Country Hobbies/Big Valley Ent., 614 W. Denver Ave., Gunnison, CO 81230; (800) 862-7196.

Arctic Airport

Calling all snowbirds

Now any snow-covered open area or frozen pond can become your "arctic airport" in about one hour. That's how long it takes to mount Du-Bro's Snowbird Skis to a .40- to .60-size model with either duralumin or wire landing gear. Featuring a torsion-bar design, Snowbird Skis flex on take-offs and landings yet remain in a positive lock position while in the air. They come in black or fluorescent pink.

Du-Bro Products Inc., 480 Bonner Rd., P.O. Box 815, Wauconda, IL 60084; (800) 848-9411; fax (847) 526-1604.

ALL-IN-ONE PROP WRENCH

Is your flight box weighing you down? Can't seem to find the right wrench? Tired of losing your tools in the grass? The Robart All-In-One prop wrench can solve all of those problems and more; it has both U.S. customary and metric sizes, and it replaces 12 standard wrenches. The All-In-One's design helps to end flight-box clutter; its size makes it easy to see and hard to lose, the thin profile works on all types of prop nuts (use two for lock-nut applications), and it's extra long for extra torque. The All-In-One prop wrench is heat-treated tough and plated for long life.

Robart Mfg., P.O. Box 1247, St. Charles, IL 60174; (630) 584-7616; fax (630) 584-3712.

LUNCH-BREAK JAKE

You never know when the mood to fly will strike, but you'll always be prepared with the SS Jake: it fits in the trunk of your car! According to FunAero R/C, Jake flies like a trainer with a Norvel .049 and like a "spirited aerobat" with an .074. The kit features all

laser-cut parts, CAD-generated plans and a photo-illustrated manual. Specs: wingspan—45 inches; weight—25 ounces; 4-channel control function. Mini or micro radio gear is recommended, but standard-size gear will fit.

FunAero R/C, 4385 Red Rd., Dalzell, SC 29040; (803) 499-5487.

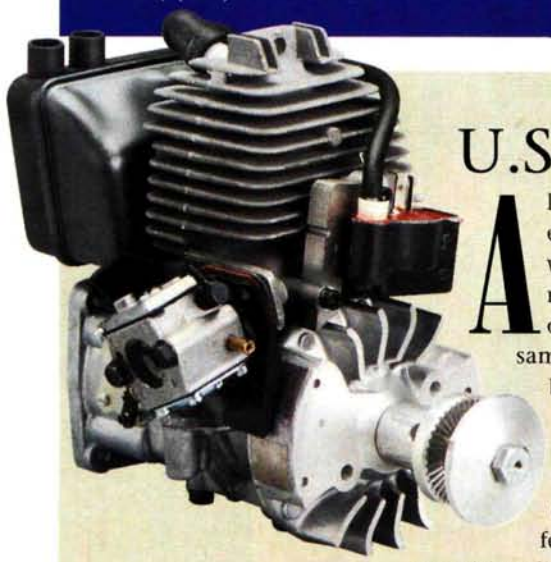
TERRY

High-performance "Plug & Fly"

The all-injection-molded-foam Terry was conceived by Graupner's top sailplane designer, Werner Detweiler. Although the Terry is an all-foam, quick-assembly model, reports indicate that its low-drag design results in a very high-performance sailplane. According to Hobby Lobby Intl., the Terry is "... a spectacular performer, yet easy to fly, with park-flyer-like landing speeds. We watched it do a very large loop with power cut at the top of the loop, then continue the loop in a glide—and then do a second loop on the same flight path—without power!"

It can be assembled quickly and has features such as servos and a receiver that are simply pushed into foam slots and are held with epoxy glue. Specs: wingspan—41 inches; length—32 inches; wing area—265 square inches; flying weight—19 ounces; 3-channel control and a NACA 009 airfoil.

Hobby Lobby Intl., 5614 Franklin Pike Cir., Brentwood, TN 37027; (615) 373-1444; fax (615) 377-6948; www.hobby-lobby.com.



U.S. ENGINES—*Back and better*

Along with several design improvements, U.S. Engines' gasoline-ignition giant-scale engines are now manufactured using a new process that increases their performance—without increasing their price. Both the 41cc (left) and the 35cc are now CNC-machined for better overall quality and consistent parts fit. To increase engine life, overall durability and performance, the piston sleeve now features nikasil plating—the same plating found on high-end chainsaws. The carburetor has been repositioned farther away from the prop for safer adjustments, and the new and improved muffler is designed specifically for RC airplane applications; it features two exhaust ports instead of one. Desirable features from the original design, such as capacitive discharge ignition (CDI), full roller bearings, a dynamically balanced flywheel and included mount, have been retained. Specifications for the 41cc: bore—1.57 inches; stroke—1.28 inches; power output—3hp; weight with standard muffler—4.5 pounds; recommended props—18x12 and 20x8.

Specifications for the 35cc: bore—1.44 inches; stroke—1.28 inches; power output—2.4hp; weight with standard muffler—4.5 pounds; recommended props—18x10 and 18x8.

Great Planes Model Distributors Co., P.O. Box 9021, Champaign, IL 61826-9021; (800) 682-8948; fax (217) 398-0008; www.greatplanes.com.

HINTS & KINKS

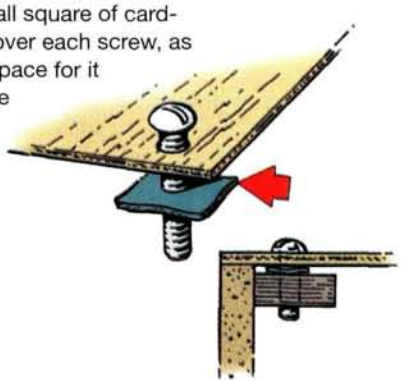
BY JIM NEWMAN

SEND IN YOUR IDEAS. *Model Airplane News* will give a free one-year subscription (or one-year renewal, if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we can't acknowledge each one, nor can we return unused material.

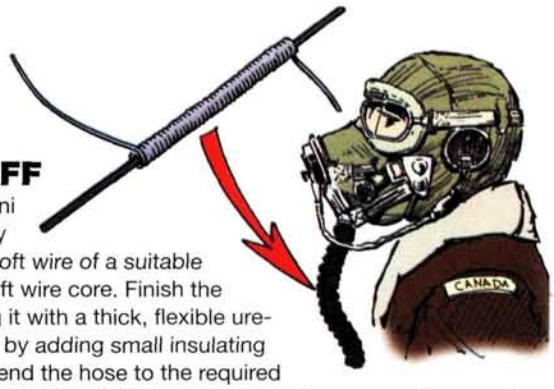
FAITHFUL RETAINERS

Retain hatch screws so they will not fall into the grass by forcing a small square of cardboard or gasket material over each screw, as shown. Be sure to allow space for it between the hatch and the attachment block.

Keith Abbott, San Diego, CA

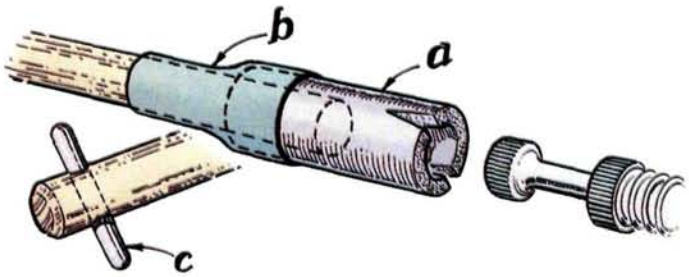


HOSED OFF



Create scale, mini oxygen hoses by tightly winding soft wire of a suitable size around a soft wire core. Finish the hose by painting it with a thick, flexible urethane enamel or by adding small insulating shrink-sleeve. Bend the hose to the required shape, and glue it to the pilot's oxygen mask. Some countries used black rubber hose; others used rubber hose covered with a finely woven fabric in a dark olive green.

Jim McCoul, Orlando, FL



SAFETY TWIDDLER

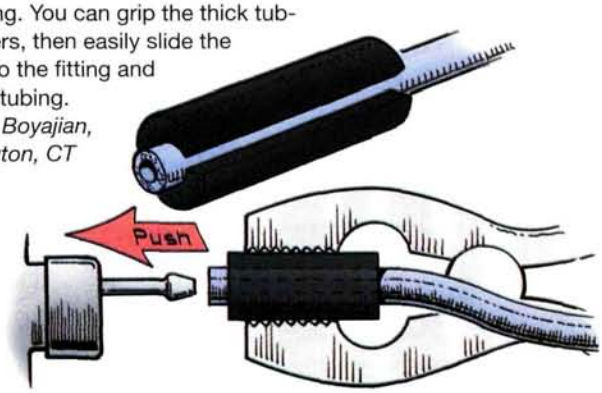
Keep fingers well away from the propeller arc with this extended needle-valve "twiddler." Force thick rubber tubing (a) onto a long dowel or arrow shaft, then secure it with shrink-sleeve or adhesive electrical tape (b). Glue in a T-bar made of wire or a cut-off nail (c) for a better grip.

Mike Hall, London, OH

BEING PUSHY

It's easier to push tightly fitting fuel line onto a fitting if you first enclose the end of the line in a short piece of thick-walled rubber tubing. You can grip the thick tubing with pliers, then easily slide the fuel line onto the fitting and remove the tubing.

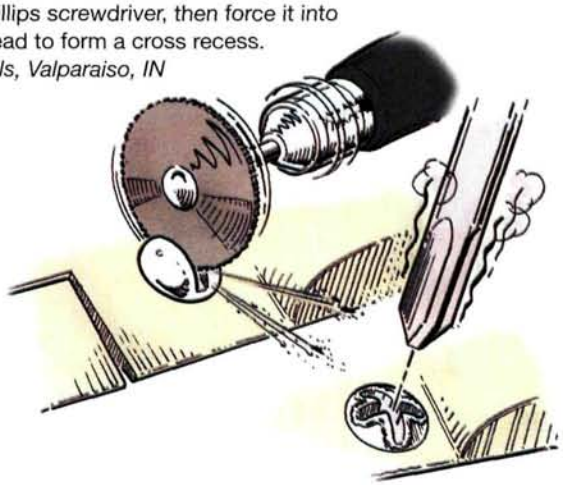
Martin Boyajian, Torrington, CT

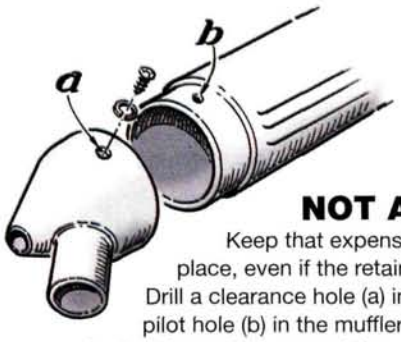


BOLT RESCUE

If you damage the heads of nylon wing screws by using the incorrect screwdriver, you can remove the damaged screw by cutting a new slot with a Dremel slitting saw. Another method is to heat a Phillips screwdriver, then force it into the screw head to form a cross recess.

Brendan Mills, Valparaiso, IN





NOT A LOSER

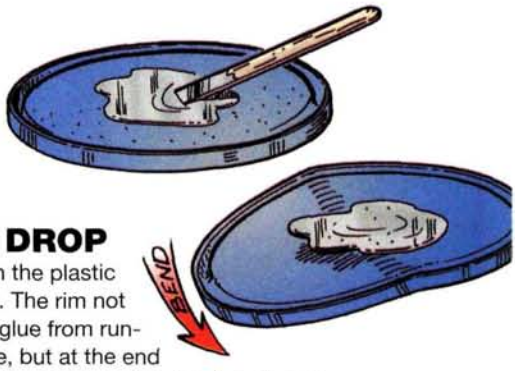
Keep that expensive muffler endcap in place, even if the retaining screw falls out. Drill a clearance hole (a) in the endcap and a pilot hole (b) in the muffler flange, then drive in a short self-tapping screw with a spring washer under its head. To change the tailpipe angle, drill new holes—not a big deal.

Ed Laco, Lake Station, IN

SPARKLING TAIL SPRING

Modify a flexible plastic toothbrush handle to become a tail-wheel spring. Cut off the excess, reshape it using a well-directed heat source, then drill it to accept mounting screws and a pop rivet of the proper size as a bushing. Connect this to the rudder horn with a spring or a rubber band.

Kenichi Yarita, Kasukabe, Saitama, Japan



GOOD TO THE LAST DROP

Mix your epoxy on the plastic lid of a coffee can. The rim not only prevents the glue from running over the edge, but at the end of a building session, you can also flex it and peel off the cured epoxy, and the lids last for years.

Manuel Ornelas, Hayward, CA

ONE MAN'S TRASH

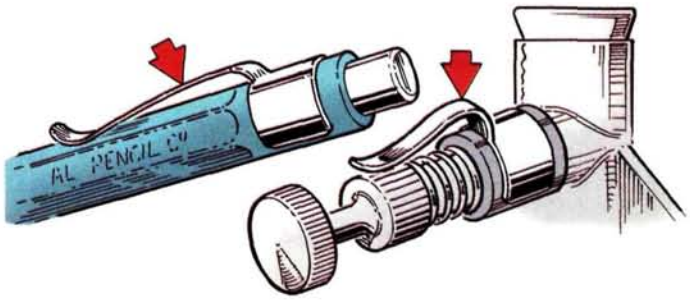
An inexpensive, wire-formed, garbage-bag holder can become a useful model support stand. Split some foam pipe insulation, then tape it over the top crossbars to prevent damaging the model's finish, then fasten some cord between the top of the legs to keep them from spreading too far. Stout coat-hanger-wire hooks driven into the ground over the bottom crossbars will prevent the unit from being blown over.

Jack Dundas, Ridgeville, Ontario, Canada

REFLECTIVE RATCHET

The fancy, chromed clip on a pocket pen or pencil can be shortened and modified to make a useful spring ratchet on your needle valve. Snap it over the needle housing so it bears firmly against the knurling, and it will securely hold the needle setting.

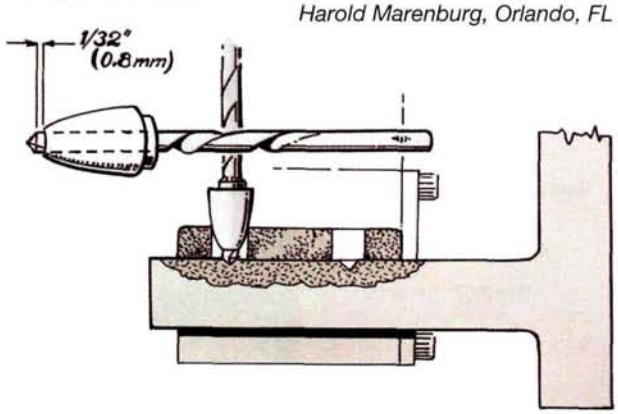
Ray Shroba, Minooka, IL



SELF-CENTERED

Use a self-centering drill to drill correctly positioned "dimples" in engine mounts, with the engine-mounting lugs as a drill guide. Epoxy the metal point from a ball-point pen onto a suitable drill, leaving just a small amount protruding. Insert the point into the mounting holes, and spin the drill momentarily to make four dimples. Remove the engine, then use a bit of the proper size to drill through the mounts.

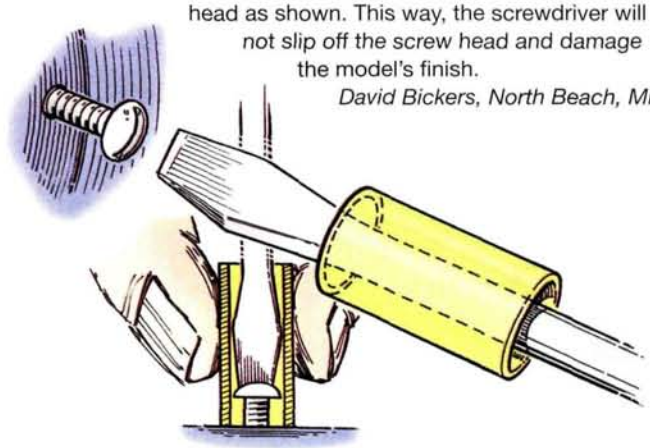
Harold Marenburg, Orlando, FL



PAINT GUARD

Before tightening cowl or hatch screws, slip a piece of closely fitting plastic tubing over the screwdriver to enclose the screw head as shown. This way, the screwdriver will not slip off the screw head and damage the model's finish.

David Bickers, North Beach, MD



PILOT PROJECTS

A look at what our readers are doing

SEND IN YOUR SNAPSHOTS. ***Model Airplane News*** **is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable. We receive so many photographs that we are unable to return them.**

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in!

Send those pictures to: Pilot Projects, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

2000 "PILOT PROJECTS" WINNER

You, our readers, send us hundreds of great "Pilot Projects" entries every year. We look through them all, and our favorites appear in the pages of *Model Airplane News* each month. A few are real standouts, and it's a struggle to choose "the best of the best" to receive our annual award. After much deliberation, therefore, we have selected Robert Huisinga of Freeport, IL, as this year's winner of $500, a one-year subscription to *Model Airplane News* and a *Model Airplane News* cap and T-shirt for his beautiful ¼-scale Fairchild F24W46. To build the 9-foot model, Robert used his own plans, which he adapted from the full-size factory drawings.

Congratulations, Robert; and thanks to everyone who sent in an entry last year. We love seeing the products of our readers' talents—keep 'em coming!

SEEING DOUBLE

If imitation is the sincerest form of flattery, then Jim Morrow's 101-inch-wingspan AT-6 must have made Al Goss—owner of the full-size Texan—blush at the 2000 Reno National Air Races. Jim, of Williams, CA, reproduced the details of the original with impressive accuracy. He started with a Saxon kit and added a Zenoah G-62 for power. The 32-pound giant-scale model uses Futaba radio gear, and Jim added Robart retracts and wheels, then capped off his model with a Tru-Turn spinner. Now all he needs is a scale canopy cover!

PERFECT LANDING

Ron Tipler of Wenatchee, WA, has an eye for detail. From every angle, his ¼-scale Ryan PT-22 looks incredibly authentic. Ron started with an Ikon N'West semi-kit but took his project much further. The Ryan's wingspan is 90 inches, it weighs 21 pounds, and it's powered by an O.S. BGX-1 35cc glow engine. The fuselage is fiberglassed and finished in Presto chrome covering; Ron used glue mixed with aluminum powder to simulate rivets. He painted the insignias by hand and included scale flying wires. The most remarkable feature of Ron's Ryan is the scale landing gear. Ron measured a full-size Ryan's gear and used the measurements to make ¼-scale drawings. He then made all the parts from aluminum and brass tubes and bar stock and assembled the fully functional gear. Wow!

STELLAR KOMET

Bob Chubb of Stowe, PA, went all out with his first scale project: an 82-inch-wingspan Messerschmitt Me 163 Komet Rocket Fighter. Based on Jim Kiehl plans, the Komet is fully balsa-sheeted and covered in fiberglass cloth and resin. Bob covered the control surfaces in fabric and crafted a functional scale drop-off takeoff dolly. A SuperTigre .90 powers the Komet, and its paint scheme was derived from the original "White 14" WW II pattern using water-based polyurethane. The final touch came at the 2000 Warbirds over Long Island, where Bob met Rudolph Opitz—original test pilot of the full-size Komet—and got him to autograph the model.

BUGGING THE NEIGHBORS

You have to wonder just what Gary Villette's neighbors in Abbotsford, B.C., Canada, thought the first time they saw his Sand Hills Hornet model flying around. Gary's Hornet is 50:1 scale and weighs 8 pounds—yikes! The shell is fiberglass and papier-mâché, and the legs are foam. It uses 30-size helicopter mechanicals and is powered by an MDS .38H, so it even sounds like a giant bee! Gary reports that it turns every head at the field. We imagine that when unsuspecting bystanders see a 3-foot-long bee flying around, they probably "turn tail" as well!

VIVE LA DIFFERENCE!

This 1/12-scale B-57B Canberra is a unique scratch-built warbird. Robert Pease of Astor, FL, built this 64-inch-wingspan model. For power, Robert uses two converted O.S. car engines spinning two Kress 720 fans. The B-57 weighs 12 pounds and includes functional flaps and retracts. This model's features include a scale hinged canopy and a cockpit with wonderfully authentic details. Particularly noteworthy is the gyro Robert incorporated to ensure stable flight even if one of the engines fails.

FAITHFUL CONVERT

Unique RC model projects can come from kits that were never intended for RC. That's the way Ray Mead of Cypress, TX, looks at his Guillows B-29 Superfortress. This isn't the first kit he's converted to RC; he says he loves the challenge. He doesn't do it halfway, either; this B-29 uses five Hitec servos—one each for rudder, elevator, aileron, main gear and nose-gear steering. Ray used ½A scale retracts, adapting the steerable tailwheel for use in the nose. The cockpit and nose contain a scale pilot, copilot and gunner, and Ray installed flashing navigation lights. The little B-29 is powered by four Graupner geared 280 motors spinning scale 4-blade props made from sandwiched 3x5 2-blade props.

WING-WALKER BARBIE

Mika Woodward of Indianapolis, IN, knows how to put on a show with his Great Planes Giant Aeromaster. Instead of sawing Barbie in half and stuffing her into the cockpit, Mika decided to make a wing-walker out of her. A SuperTigre 4500 2.8 spins a 22x8 prop, and Mika modified the struts for better knife-edge flight. The 20-pound Aeromaster incorporates a 32-ounce smoke tank with a TME smoke pump and uses two receivers running eight JR 517 servos. Ken pilots from the open cockpit, and Mika reports that the plane is a real showstopper when it flies down the runway inverted—smoke streaming, Ken's scarf blowing in the wind, and Barbie's hair dragging along the ground!

BLAST FROM THE PAST

This semi-scale BT-9 Army trainer has graced the pages of *Model Airplane News* before, but we thought it deserved another day in the sun. In its May 1970 incarnation, it was a North American AT-6 Texan! Don Carkhuff of Florence, SC, co-wrote the original construction article, and he has kept the plane in his attic all these years. He recently decided to clean the dust of 25 years off it and get it airworthy again. While giving it fresh paint, Don decided to convert his AT-6 to a BT-9—forerunner of the Texan. Don removed the wheel-well fairings, added fixed leading-edge slots, revised the landing gear and gave it the trainer's paint scheme. Just like that, the transformation was completed. Don reports that it flies just as well as it ever did, too.

ONE OF THE FAMILY

We just couldn't resist including Richmond Tripp's little Kadetito in "Pilot Projects," especially since it's built from *Model Airplane News* plan no. FSP11941. Richmond, of Dighton, MA, chose this plane because flying sites are becoming scarce in his area, and he wanted something he could fly in his backyard. The Kadetito uses a Graupner 400 electric motor spinning a 9x5 prop, and it's powered by a 6-cell 600AE battery pack. What caught Richmond's attention was the designer's name: Alex MacLeod. A descendant of the MacLeod clan as well, Richmond adorned the nose of his plane with the family crest.

A 10th anniversary after-burner celebration

Heart of Ohio Jet Scramble

The paved pit area; depending on wind direction, models taxi out of one end to take off and then taxi in from the other end after landing—very convenient.

by John E. Jundt

Flown by Dave Malchione Jr. and Sr., this BVM Phantom F-4 flew many sorties. Dave Jr. won the Best Twin award.

PHOTOS BY GERRY YARRISH & JOHN E. JUNDT

In August, pilots from as far away as Texas, New Hampshire and Florida converged on Darby Dan Airport west of Columbus, OH, for the 10th annual Heart of Ohio Jet Scramble. Over three days, the event enticed a total of 5,828 attendees, and 81 fliers from 19 states toted a gaggle of 118 jet planes.

Always hosted by The Ohio Radio Kontrol Society (TORKS) and now under the leadership of club president Matt Short, for all 10 years, the dynamic duo of chairman Terry Nitsch and CD Bill Midgley have headed the organizing team. These great guys work hard all year and during the long weekend to make sure the Scramble runs smoothly and is enjoyed by the participants and spectators. Safety is always a number-one priority, and TORKS ensures a great public relations event that showcases safe, entertaining RC model jet flight and model aviation in general. It's a fine example for all.

This sweptwing twin .90 ducted-fan-powered F-14 Super Tomcat flew several times and put in a great performance. Charlie Lyons built the model from a Yellow Aircraft kit.

Right on the numbers; Dean Digiorgio brings in his turbine-powered CJM Grumman Cougar for a smooth landing.

All six flight stations—every one in almost constant use—have safety barriers between the pilots and the runway. Constant communication between air-traffic control, ground control and pilots, who ask the "air boss" for permission take off, is vital. Pilot's stations all have a "spotter" equipped with a walkie-talkie that allows him to keep the pilot aware of what's going on, so pilots don't have to having to worry about potential air and ground conflicts. The steady stream of takeoffs and landings lent the event an authentic "Oshkosh" feel.

Bob Violett prepares his Bandit for another flight.

Six, movable, triangular, metal-faced shields diverted the hot gases produced by the turbine-powered airplanes to protect other airplanes and any people walking behind them. Further pilot pampering was provided by two "pilot taxi squads," who drove out as needed to assist pilots and to retrieve aircraft that failed to taxi back under their own power. The "Airedale retriever teams" maintained a constant vigil for planes whose pilots couldn't prevent them from ending up somewhere on the back 40. While its pilot remained at the compound, his errant plane would be retrieved by one of the teams.

In excellent weather, the 75x7,000-foot concrete runway was put to good use, and the airport was closed to full-scale aircraft except for one noontime Saturday exception. Darby Dan is an

Screaming Arrow

In 2000, to celebrate its 10th anniversary, the Heart of Ohio Jet Scramble included low-level aerobatics demonstrated by a full-size HA200 Saeta jet. Piloted by Curt Arnspiger of Worthington, OH, the aircraft thrilled the crowd with high-speed flybys, wing-overs and steep pull-ups. After the 12-minute show, Curt landed the HA200 and taxied to the far end of the runway where we were allowed a closer look.

Curt has logged more than 2,000 hours of flight time and more than 500 hours of aerobatics. He also has a level-one, low-level flight waiver that permits him to fly maneuvers very close to the deck! Why the name "Screaming Arrow"?— because of the twin engines' unique howl when Curt displays his talents.

Craig Gottschang shows off his AMT-powered BVM F-4 Phantom and the Best Turbine award it won for him. Craig originally powered it with twin .90 ducted fans.

AWARDS		
Best Finish	Anthony Wiencek	BVM Maverick Pro
Best Twin	Dave Malchione	BVM F-4 Phantom
Outstanding Flight	Lewis Patton	CAI Raptor
Craftsmanship	Scotty Bolduc	CAI Grumman F9F Panther
Top Gun Award	David Ribbe	BVM Balsa Bandit
Best Markings	Keith Horton	BVM Aggressor II
Best Turbine	Craig Gottschang	BVM F-4 Phantom
Most Spectacular Demise	Rod Snyder	FiberClassics Kangaroo

Winner of the Top Gun award, Dave Ribbe poses with his BVM Balsa Bandit. Powered by a Sofia 850 turbine, the model has balsa wing panels and tail and a fiberglass fuselage. Dave says it typically gets 10- to 12-minute flights—a good air time for a turbine.

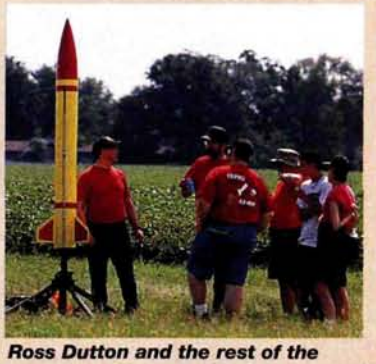
active full-scale airport in a very large private country estate. This pastoral setting allows unrestricted flying and visibility—one of the many reasons Scramble pilots return year after year. The large, well-manicured, elliptical lawn that separates the runway and two separate taxiways from the pit area allows separate taxi-in and taxi-out, so no one fouls anyone's run. This also increases efficiency and helps keep the sky busy with jets. The layout also generates a parade of jets that pass through the protected area right in front of the spectators, so they get an up-close view of the action.

Just 500 feet from the runway, a large hangar is available for pilots to leave their planes and equipment when they charge their batteries. It was also a great place for the Friday-night Pilots and Workers Party hosted by the Dinneen Excavating Co. of Plain City, OH. Over 250 people joyfully

Lewis Patton's CAI Raptor goes ballistic while showing off an impressive smoke trail.

Lewis Patton, takes his AMT T280-powered CAI Raptor for a walk; it has a great smoke system—a real crowd-pleaser.

Half-time airshow



Ross Dutton and the rest of the gang from Magnum Rockets prepare to punch big holes in the sky. Demonstrating 6- and 7-foot model rockets, these guys require FAA clearance when they launch their mighty missiles.

Each year, the half-time airshow gives the competitors a well-deserved rest while the crowd enjoy some of the best demonstration flights RC has to offer. Included in the lineup was an awe-inspiring Masters-level aerobatics performance by Frank Knoll, who flew his 40-percent-scale Carden Edge 540. Frank does every trick in the book, including close-in hovering and even an entire aerobatics sequence flown dead-stick.

Hot-dog pilots Dan Monroe and Wendell Adkins flew award-winning 3D helicopter aerobatics. If you think inverted hovering is impressive, wait till you see 4-point-roll hovering, inverted autorotations and tail-first loops and rolls. The crowd really paid attention to these guys.

During the half-time show, Frank Knoll affectionately pats the rudder of his Carden Edge 540 as it hovers right next to him on the runway.

Though it wasn't RC, Ross Dutton and his friends from Magnum Rockets launched their monster missiles into the wild blue yonder. These rockets go so high that special FAA approval is required to ensure they don't interfere with commercial air traffic. We're talking high-altitude here!

To get the audience involved, Gerg Poppel and Frank Knoll teamed up with Bill Lane's Red Robin—a giant trainer turned bomber—for the ever-popular egg-drop-and-catch contest. Catching an egg without breaking it earned a $50 prize, and children of all ages tried their hand at this sometimes gooey activity.

Everyone enjoys an airshow, and the Heart of Ohio Jet Scramble half-time entertainment is truly a show within a show.

The big "kid" in the middle, Greg Poppel, directs the rest of the kids for the half-time show's egg-drop contest.

Bob Violett's Ram turbine-powered Bandit comes in after a great flight. Bob demonstrated the plane's great high-speed and slow-speed flight characteristics.

consumed an abundance of food and beverages, and we still had room for the Saturday-night steaks at the banquet held near the active runway of the nearby Bolton Field Airport!

THE FUTURE IS HERE!

Seeing the manufacturers, vendors and pilots at an event such as this reminded me how much development this segment of our hobby has seen over the past 10 years, and it has similarly grown in popularity. Who would have foreseen this rapid growth? It wasn't too long ago that gatherings of fan-jetters mainly spent their time tinkering, trying to figure out how to keep pipes on engines and the engines running for a full flight.

Much of this development is the result of the close relationships between companies who develop new fan-jet products and the pilots who provide feedback. Many of us take the technology for granted: just crank it up and fly. Look at the rapid growth in turbine engines and the kits that support them. In 2000, 47 turbine-powered jets from six manufacturers were flown at the Scramble—a 27-percent increase over last year and making up 40 percent of all the engines used this time.

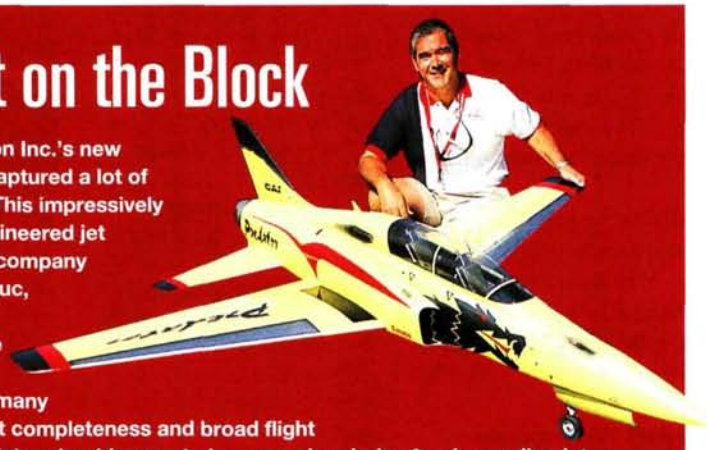
Greg Gottschang flies with the new BVM* twin-nozzle turbine tailpipe; David Ribbe does high-speed maneuvers showing that a well-designed and well-made turbine-powered BVM Balsa Bandit will easily handle the stresses of jet flight; and, with his all-wood Vampire, Wayne Jones shows that this natural material is still very much with us and functioning well.

With his beautiful, award-winning, Maverick Pro fan jet, Anthony Weincek demonstrated the use of the new—and expensive—Chrome Illusion paints from Du Pont. Louis Patton made many flights with his AMT T280-powered Crow Aviation Inc.* Raptor jet and showed that a smoke system can be reliable as well as a crowd-pleaser. The BVM team constantly demonstrated super-smooth landing stops with their new Smooth Stop brake valve.

Technology notwithstanding, when a group of

Dave Malchione Jr. brings his F-4 Phantom back to the pits after a great flight.

New Kit on the Block



Crow Aviation Inc.'s new Predator captured a lot of attention. This impressively large and well-engineered jet was shown off by company owner Scotty Bolduc, who said that the kit will be available by the time you read this. With its many features, overall kit completeness and broad flight envelope, the Predator should prove to be a popular choice for demanding jet pilots everywhere.

SPECIFICATIONS

Length: 96 in.

Wingspan: 87 in.

Wing area: 1,450 sq. in.

Weight: 36 lb. (ready to fly, dry)

Power: AMT AT450 turbine (35 lb. thrust)

Features: the molded fiberglass, Kevlar and carbon-fiber kit has everything, including wheels, brakes, retracts, etc.; buyers add only a radio and a power system. The horizontal stabs and nose section can be removed for transportation; options include a scale cockpit kit and wing pylons.

Scotty Bolduc shows off his company's new CAI Predator. Powered by a 35-pound-thrust AMT AT450 turbine, the model's performance is topnotch.

Piloted by Scotty Bolduc, the Crow Aviation F9F Panther gracefully reaches for the pavement.

Hey! Get this "c off my back! Sc Bolduc's ground crew brings his Grumman Panth the pit area. Big model!

us fly, we're always aware that one of us might take home a plane in a less than pristine condition. We love to hate ourselves for sympathizing with—and yet enjoying—an event's "most spectacular demise." In 2000, our feelings were with Rod Snyder of Piney Flats, TN, and hi 750-powered, FiberClassics* Kangaroo. According to Rod, "dumb thumbs" that caused his 'Roo to run out of airspeed tude and options all at the same time.

It was fitting that as the flight line closed at 3 p.m. on Sunday, Scramble chairman Terry Nitsch made the last flight with his BVM Bandit powered by an AMT T180, and his performance was impressive. After that, he handed out the many awards and prizes, and then it was time to leave—pilots and spectators eager for 2001's encore.

If you find you're in the area at the proper time, don't miss the Scramble; for information on the schedule, contact Terry Nitsch—tsnitsch@msn.com. See you there!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✈

SPONSORS

Benefactors: Arris Co., Aviation Mic Jet Technologies, Dinneer Excavatir Leigh A. R. Pickenpaugh.

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Patrons: Architech Glass, Chuck's Sculptured Glass, Dog Talk, Groli's F Furniture, Holingsworth Sign Co., Jacquelyn's Alternatives, Saxton's F Estate.

Terry's Rafale

Bob Violet congratulates event chairman Terry Nitsch on his firsts in Top Gun and the AMA Nationals with his BVM Rafale B-01.

In addition to his duties as chairman and as an active coordinator for the Scramble, Terry Nitsch is also a talented modeler and scale competitor who has many first-place awards to his credit. A special treat was Terry's award-winning Rafale B-01, which was on display. Built from the new BVM kit, the 61-inch-span B-01 has two AMT turbines for power! The Rafale is 1/5 scale, weighs 35 pounds and has a JR radio system. A fully detailed cockpit and scale landing gear add much to the model's scale fidelity; functional lighting and an impressive scale finish are the icing on the cake.

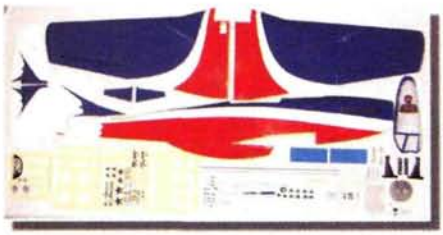
With a 95.583 static score and a total score of 191.791, Terry took first place in Expert at Top Gun 2000, and he also placed first in Expert at the AMA Nationals in 2000. Seeing models of this caliber up close is a great opportunity to appreciate cutting-edge technology and award-winning modeling skills.

New

ARF

Specifications

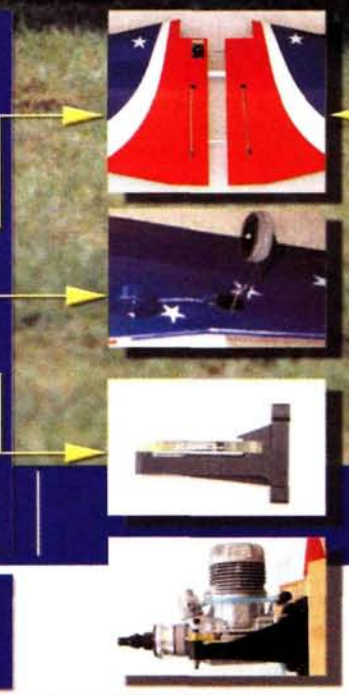
- Wing Span: 80.0 in / 2030 mm
- Wing Area: 1155 sq in / 74.5 sq dm
- Fuselage Length: 71.0 in / 1800 mm
- Flying Weight: 13.0 lb / 5900 g
- Engine: 0.91 - 1.4 cu in 2-stroke
  1.4 - 1.8 cu in 4-stroke
- Radio: 5 channels, 6 servos



- Aluminum spinner (ø127 mm)
- Anti-vibration engine mount
- Detachable 2-piece main wing
- Detachable stabilizer
- Retractable landing gears
- Pull-pull controls on rudder and elevator for more precise control
- Elevator bellcrank to eliminate any differential throw
- Fiber glass cowl comes pre-painted with 3-D template
- Canopy and pilot come pre-painted

This almost-ready-to-fly model airplane features

- **Our instruction manual only has 30 steps of pictorial illustration on how to install engine and radio equipment for this big model.**
- **Simple ? Yes.**
- **Main wing and stabilizer are detachable and plug-in type.**
- **Hinges are pre-glued.**
- **Retracts are already installed.**
- **Anti-vibration engine mount comes with blind nuts are already installed at the fire wall.**
- **All you need is installing your engine and hooking up the servos.**
- **We completed the installation of our prototype under 10 hours, may be you can do it faster.**



HOME

Big is Simple

P-51D Mustang GS

Big is Beautiful

Big models fly differently to smaller models.

Common maneuvers as stall turns look so much more elegant.

Scale-like flight is easy and cross wind seems to subside.

Worry about the complicated installation, transportation and price ?

- Our P-51 Giant Scale Series provide the best solution for you.

With the detachable 2-piece wing and stabilizer design, you don't need a truck to haul this 80 in. plane around. You can also save a lot of storage space for other models.

You don't have to spend big bucks. Just spend a little and this big and beautiful Miss America is yours.

Big is small

Big is Little

THE WORLD MODELS MANUFACTURING CO. LTD.
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Website: www.theworldmodels.com www.radarrc.com

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

Sig Mfg. CAP 231EX

by Rick Bell

It should come as no surprise to anyone who has been to the flying field lately that ARFs are more popular—and more abundant—than ever. What is surprising is just how good these kits are, and that they keep getting better. At the forefront of this trend in quality ARFs is Sig Mfg.*: first with its Kadet LT-40 trainer and now with the fantastic CAP 231EX. This high-performance, IMAA-legal aerobat comes completely built and is covered in dark yellow Ultracote, so all the hard work has been done by the time you open the box.

State-of-the-art aerobatic ARF

SPECIFICATIONS

Model: CAP 231EX

Manufacturer: Sig Mfg. Co. Inc.

Type: 1/4-scale aerobatic monoplane

Wingspan: 73 in.

Wing area: 962.5 in.

Weight: 10.5 lb.

Length: 65.5 in.

Engine req'd: 1.20 to 1.50 2-stroke or 4-stroke

Radio req'd: 4-channel with 6 servos

Engine used: Saito 1.50 4-stroke

Radio used: Futaba 9Z

List price: $325.95

Features: painted fiberglass cowl, wheel pants, molded canopy tub and tail fairing; clear canopy; wheels; steel axles; aluminum landing gear; fuel tank; leaf-spring tailwheel assembly; hardware; decals; instruction manual.

Comments: the Sig CAP 231EX ARF looks great and performs flawlessly. All components are covered in Ultracote, and the fiberglass parts are painted. The decals are impressive and apply easily. Assembly is quick and easy.

Hits

- Great instructions make for quick and easy assembly.
- Includes good hardware and painted parts.
- Outstanding looks.
- Excellent flying qualities.

Misses

- Warped wing-servo hatches.
- Loose glue joints in fuselage.

[Editor's note: these have both been corrected in subsequent kits.]

OPENING THE BOX

My first impression was "Wow! What a great-looking model!" When I removed the fuselage, wing panels and tail surfaces, I noticed how light everything was—atypical for an ARF. The kit contains a painted fiberglass cowl, wheel pants, a molded canopy tub and tail fairing, along with a crystal-clear canopy, a generous hardware package, lightweight wheels, steel axles, aluminum landing gear, a fuel tank, leaf-spring tailwheel assembly, comprehensive instructions and a magnificent set of decals. The hinge slots are cut and ready for hinge installation. All of this adds up to an excellent value.

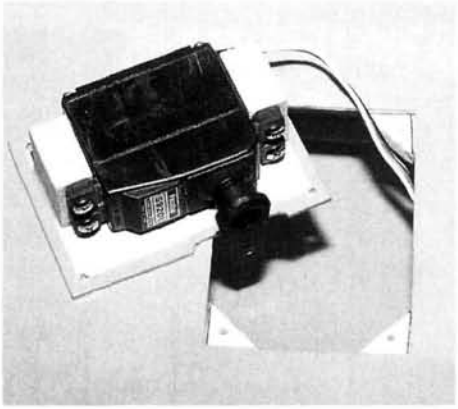
The manual is excellent; it provides sound advice on radio equipment, engine selection, tools and supplies needed for assembly. Before beginning, go over the covering with an iron to remove any wrinkles and to seal any loose seams.

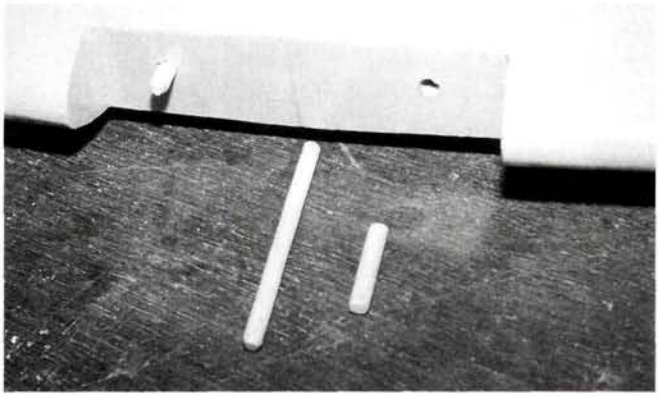
WING ASSEMBLY

The first step is to hinge the ailerons; the kit comes with Sig's double-X-pinned nylon hinges that must be epoxied. I decided to replace these with Sig's CA Easy Hinges to minimize the gap between the aileron and the wing. I have used these CA hinges in planes of this size for years, and they are very reliable.

After you've hinged the ailerons, remove the covering from the wing-dowel-mounting holes and the servo hatches in the wing panels. Next, glue the plywood mounting pads in the servo bays to serve as screw anchor points for the hatches. When I began to mount the servos to the hatches, I encountered a problem: the hatches were warped. I tried heating them with a hot iron to pull the covering, without success. I ended up making new hatches using ply from my scrap box, and I covered them with dark yellow Ultracote to match the airframe. Mount the servos to the hatches, string the servo extensions through the wing panels and assemble the aileron linkages before you join the panels. The laminated plywood wing joiner fits well to the ends of the wing panels. I joined the panels using Anchor Bond* 2-hour epoxy.

Now it's time to add the two front wing hold-down dowels. I thought the supplied dowels were too short; they only engage the front wing plate. The rear of the dowels was not supported, so I made new, longer dowels and anchored them in the joiner brace by drilling a hole for each dowel using the front plate holes as a guide. Next, I mounted the wing to the fuselage as the manual instructed. The sharp threads in the metal blind nuts stripped the nylon bolts the very first time they were inserted, so I added hardwood blocks and tapped them for ¼-20 nylon bolts.





Above: the aileron servos attach to hatches that seat in the servo bays in the wings. The hatches in the kit were slightly warped, so replacements were made form scrap ply.

Right: two short hold-down dowels secure the wing to the fuselage. Fabricating a longer dowel adds support to the wing.

FUSELAGE

The front and rear deck sheeting was loose along the center seam in a couple of spots, so I fixed it with thin CA. Also, some of the lite-ply had delaminated around the edges, so I soaked the areas in question with thin CA to prevent the delamination from spreading.

The engine mounts provided with this kit work well with a wide variety of engines; I chose a Saito* 1.50. To build the fuselage, first lay out the horizontal and vertical centerlines on the firewall using the existing marks, then measure the

FLIGHT PERFORMANCE

I had no engine-performance problems with my well-broken-in Saito 1.50. After the required ground checks, control surface direction, radio range checks and taxi tests, I was ready to go!

• TAKEOFF AND LANDING

The big Saito spins an APC* 16x8 prop and gets the CAP airborne quickly with only half throttle. The CAP needs only minimal rudder inputs to stay on line while on the ground, and it's easy to keep the CAP on the ground for graceful takeoff rolls once the tail comes up. The large control surfaces provide a solid feel, and this makes landing uneventful. The CAP likes a 3-point touchdown—wheeled landings require a long rollout.

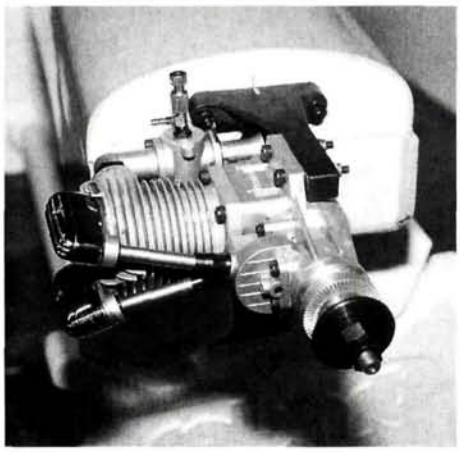
• GENERAL FLIGHT PERFORMANCE

With the recommended control throws and a forward CG, the CAP feels very solid in flight and has no vices. The low rates make all-around sport flying very comfortable, while the high rates provide more thrilling aerobatics. This CAP makes a good 3D aerobatic trainer.

• AEROBATICS

Easy and fun are the key words here! The Saito 1.50 has more than enough power to muscle the CAP through any maneuver. Loops can be very large, and rolls are axial with very little elevator needed. Point-rolls are no-brainers, and the CAP knifes with just a hint of pitch/roll coupling. Inverted flight needs a little elevator to maintain level flight. Overall, the Sig CAP is an extremely capable aircraft.

crankcase width (mine was 1.80 inches) and divide by two. Use this measurement to mark each side of the vertical centerline. These lines are the inside locaters for the engine mounts. I like to tack-glue the



The Saito 1.50 provides plenty of power to make this aerobat perform. Be sure to make accurate measurements on the firewall to avoid drilling holes in the wrong place.

mounts (with thin CA) to the firewall so I can check their placement; this avoids drilling holes in the firewall in the wrong place. Next, mount the cowl and make the cutouts for the muffler, glow plug and needle valve. Then build the tailwheel assembly and plumb and install the fuel tank. Next, install the elevator, rudder and throttle servos, and set up the throttle linkage.

TAIL FEATHERS

Begin by accurately marking the centerline on the horizontal stabilizer and then placing the stab in the fuselage. Carefully center it and mark the bottom of the stab where it meets the fuselage. Remove the covering where you plan to epoxy the stab to the fuse—be careful not to cut into the balsa. Before I epoxied the stab into place, I checked the incidence to the wing and stab using a Robart* Incidence Meter. Mine read zero, so no adjustments were necessary.

Next, epoxy the vertical fin to the fuselage. When it has cured, hinge the rudder to the fin, attach the control horns for the pull/pull cables to the rudder and hook the cables to the rudder and the servo. Now epoxy the stab into place, trim the plastic tail fairing and glue it to the fuselage over the stab and the vertical fin. Hinge the elevators to the stab, then build and install the linkages. Instead of electronically mixing the two elevators together in the radio, I used an MPI* Miracle Y elevator splitter to produce "mirror-image" action.

Center and epoxy the horizontal and vertical stabilizers to the fuselage. It's a good idea to check the incidence on the horizontal stab at this point. When the stabs are firmly attached, hinge the rudder and elevator and connect the linkages.

The canopy fits beautifully without any trimming. The instructions call for epoxy, but black pinstriping tape and screws work well and don't ooze. The Hangar 9 instrument panel and pilot bust dress up the cockpit nicely.

FINAL ASSEMBLY

Next, assemble the landing gear and install the fiberglass wheel pants. Attach the axles to the aluminum landing gear using the supplied lock nuts and wheel collars. Use another wheel collar to hold the wheel in position and install the wheel pants over the wheels, sliding the hexes on the axle into the long slots in the wheel pants. Prop the wheel pants into position, and use the two holes on each landing-gear leg to mark where to drill holes in the wheel pants. Then install the provided blind nuts inside the wheel pants and screw the wheel pants to the landing gear.

Next, mount the canopy base to the fuselage using the provided nylon bolts and blind nuts. I painted the inside of the base a light gray and installed a Hangar 9* CAP 232 instrument panel along with a pilot bust to dress up the cockpit. The canopy fits beautifully without any trimming. The manual recommends using epoxy to glue it to the canopy base, but because epoxy would ooze inside the canopy, I used black pinstriping tape instead. I then set up the control throws as recommended in the manual and balanced the CAP using a Great Planes* CG Machine. I used a couple of ounces of lead in the nose to set the CG at the forward-most limit of the CG range.

DECAL APPLICATION

The instructions are quite helpful regarding decal application. The numerous decals are easy to apply, and they really bring the CAP to life. Be forewarned, the adhesive on these decals is very sticky! Be careful not to let the decals touch one another when you peel them off the backing; you'll never get them apart. A second pair of hands is helpful for the longer decals. The instructions tell you to use a glass cleaner such as Windex to wet both the adhesive side of the decal and the surface it's being applied to. Blot away the excess cleaner with a towel, and the decals will adhere firmly. I used trim tape to provide guidelines on the wing and fuselage so the decals would be straight. Because of the cowl curvature, I thought applying the decals on it would be difficult. But if you follow the instructions and take your time, you'll be rewarded with results that look like they're painted on.

FINAL THOUGHTS

Anyone in the market for an IMAA-legal aerobat should seriously consider the Sig CAP 231EX. I experienced a couple of problems with my kit, but they were minor and easily remedied. It would be hard to duplicate the high-quality finish and level of performance with a homebuilt kit for the price of the CAP; that alone makes it a great value. Factor in the time you save with an ARF, and this plane is an instant winner!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✚

KYOSHO Electric Learjet ARF

by Nick Ziroli Sr.

Only a few years ago, an ARF, ducted-fan Learjet would have been very unusual, and an electric one would have been totally unthinkable, but advances in electric power systems have made anything from the smallest indoor to 1/4-scale models easy to produce. Following the success of its electric-ducted-fan T-33 and F-16 models, Kyosho* introduced a 57 1/2-inch-span Learjet.

A twin ducted fan for the Sunday flier

The Learjet's fuselage, wing and tail are made of styrene foam with a hard, smooth outer surface. The fuselage halves are joined over a plywood structure to produce a strong, light assembly, and the wing and stabilizer halves are joined over foam-cores—very light and strong. The engine nacelles are also molded foam with the ducted-fan shrouds and aluminum mounting sockets in place.

PHOTOS BY WALTER SIDAS

MODEL ASSEMBLY

Though the Learjet is an ARF, a fair amount of work is required to complete it. You'll need only a few tools and epoxy. To begin, use a razor and sanding block to remove the flash at all of the wing joints; use a razor plane on the straight sections. The control-surface hinges have been molded into the surfaces. You need to cut the hinge lines through the surface, leaving short uncut sections that become the actual hinge. Cut a 1/32-inch gap at the ends of the ailerons. The control-horn torque rods are molded into the wings; nicely done. Use 30-minute epoxy (not 5-minute!) to join the wing panels. The double-plywood wing joiner allows a wide variation of dihedral. I sanded the ends to match with about 3/4-inch dihedral under each tip.

SPECIFICATIONS

Model: Learjet

Manufacturer: Kyosho

Type: sport-scale, electric, twin ducted-fan ARF

Wingspan: 57.5 in.

Length: 54.5 in.

Wing area: 574 sq. in.

Weight: 5 lb., 14 oz.

Wing loading: 23.5 oz./sq. ft.

Motors: two LeMans AP29L and 3-inch fans (included)

Battery recommended: two, 7-cell (8.4V) 1700 to 2400mAh Ni-Cd packs

Battery used: two 8.4V, 2400mAh Ni-Cd packs

Radio req'd: 4-channel w/three servos and two 30A ESCs

Radio used: Airtronics RD-6000, Airtronics Microlite 94501 servos, Kyosho Sky Victory 210 ESCs

Street price: $299.95

Features: molded-foam fuselage over plywood inner frame; molded-foam wing and stabilizer over foam-cores. Prebuilt ducted-fan nacelles. Comes with motors and fan units.

Comments: the Learjet looks great on the ground and in the air. It needs a hard surface to take off but can be modified for grass fields. Good flight performance, though not great speed. Power can be upgraded for improved performance.

Hits

- High-quality, complete kit.
- Excellent flight handling.
- Includes a nice set of graphics.

Misses

- Text in instructions was lacking, although the diagrams are good.
- Nosewheel hardware larger than strut.
- Metric Allen wrenches not included.

Above: the Kyosho Learjet kit is very complete; you need only a few tools and epoxy to assemble it. The fuse is molded styrene over a plywood inner structure; the flying surfaces are styrene over a foam-core.

Right: the plywood wing joiner is a loose fit and allows your choice of dihedral; I sanded the wing-panel ends to match with about 3/4-inch dihedral under each wingtip.

I used Airtronics* Microlite 94501 servos on all controls. These weigh about ½ ounce each and have 29 oz.-in. of torque. The instructions indicate the size of the servos but not the more important torque recommendation; the 94501 servos have proven to be adequate. The servo openings in the die-cut plywood mounting plates were a little large for the 94501s, so I glued ⅛-inch plywood strips over the plates on each end to close up the holes. The supplied clevis links that come with the preformed pushrods were too long, so instead of rebending the pushrods, I substituted small Du-Bro* links.

There's very little work required to complete the fuselage: remove the flash, cut a few holes, and epoxy some parts into place. All of the parts fit accurately. Trial-fit the motor pods onto the mounts to be sure the pylons fit into the fuselage; sand the pylon ends and mounting tabs until they are a flush fit. You'll need a 1.5mm Allen wrench to install the nosewheel strut; this isn't supplied, nor is it mentioned in the

FLIGHT PERFORMANCE

• TAKEOFF AND LANDING

The narrow main-gear width and more nosewheel steering than necessary (but less than what's called for) made the takeoff roll a little erratic. After a run of about 50 feet on a paved surface, the model was in the air and climbing at an acceptable rate.

Because just about all my flying is done off grass and the stock Learjet can't take off from grass, I tried a bungee launch. I removed the landing gear and added a ¼-inch-high, 3-inch-long skid (which also acts as a launch hook) to the battery hatch and hooked a metal ring to the back of the skid. The screw that holds the hatch in secures the hook. Sixteen feet of 5/16-inch-diameter surgical tubing supplies a gentle catapult launch into the air. I staked one end of the tubing to the ground and stretched the other end so it pulled from 8 to 10 pounds (about 20 paces). I hooked the tubing onto the metal ring on the airplane and placed the model on the ground. It's released by a helper for a reliable, consistent launch. The bungee can be set up—launch performed—and removed in a couple of minutes; this seldom interferes with other flight operations.

Landing is straightforward; the Learjet tracks right onto the runway, and positive control is maintained right to touchdown—with or without gear.

list of required tools. I managed with a regular wrench and a pair of pliers.

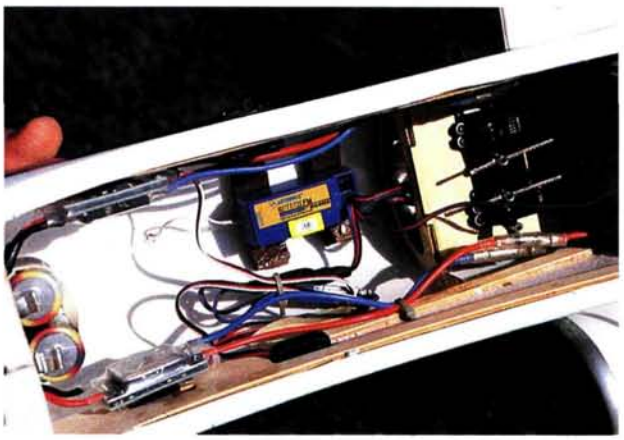
The strut wire is smaller than the holes in the steering arm and collar. I filed a flat on the back of the strut, parallel to the axle. This has kept the arm in place—even with the mismatched parts. Although the instructions don't mention it, you need to adjust the nosewheel-strut length so the fuselage will be level to the ground when it's on three wheels. I like the screw-on wheel retainers and installed them with a little thread-lock. I soldered a washer to the axle inside the wheel rather than use the supplied soft plastic tubing. Accurately aligned, freely turning wheels are important to a ducted-fan model; the fan performs at its worst during the takeoff run, so the model should roll as easily as possible.

Mounting the wing is the same as with any bolt-on wing assembly. I would have liked to have seen dimensions and hole sizes called out in inches as well as millimeters. Be sure to align the wing as shown, measuring from tips to tail. I decided to glue the wingtip tanks into place but then noticed that the instructions don't say to glue them on. It turns out that the tanks are supposed to be removed for flight. Mine are on, and as you will read in "Flight Performance," they're staying on. To hold them in place temporarily, you can use strips of the clear part of the supplied graphics.

The instructions tell you to epoxy the stabilizer into place, then cut the control surfaces free and mount the control horn, but it's easier to cut the hinges, mount the rudder horn and *then* epoxy the stabilizer into place. Position the control horn so that the screws are centered between the leading and trailing edge of the elevator; otherwise, the angle of the pushrod will not allow equal up and down control throws without offsetting the servo arm. The instructions do not mention where to place the horn.

One mystery plastic piece is not shown in the instructions: it can only be a cap for the top stabilizer fairing. I decided to leave it off.

After I had installed the servos and pushrods, I wanted to support the pushrod tubes in the aft fuselage. I cut a piece of ⅛x¾x3-inch balsa and angled the ends so it fit across the fuselage on top of the pushrods, then notched a second piece of ⅛x½-inch balsa to fit around the pushrods and glued it on edge to the first piece. These are not easy to install, but they hold the pushrod tubes securely. Make the outer pushrod tubes' ends no more than ½ inch from the servo case, and add a support at the ends to prevent the cable from flexing. The threaded end of the nosewheel steering pushrod and plastic clevis were a loose fit, so I soldered a clevis to the pushrod. Using the innermost hole on the servo arm for the nosewheel pushrod will make takeoffs easier. I also found using a small nylon clevis, like those on the ailerons, worked better on the rudder pushrod than the long clevis that is supplied. I set up all control throws per the instructions.



Two Airtronics Microlite 94501 servos and two Kyosho Sky Victory 210 ESCs control the Learjet; power is provided by two 8.4V, 2400mAh Ni-Cd packs wired in series.

The supplied ball-bearing LeMans AP29L motors and ducted-fan units fit into these molded nacelles.

Because I usually fly off grass, I removed the landing gear and added this skid, which also acts as a bungee-launch hook.

• GENERAL FLIGHT CHARACTERISTICS

Control response was very smooth, and trims were very close to perfect. The Learjet will cruise nicely at little more than ½ throttle, and it is aerobatic enough to do loops and rolls and fly inverted (while I hold a lot of down-elevator). I run the timer on my Airtronics RD-6000 transmitter for every flight and land after 6½ minutes.

MOTOR INSTALLATION

Before you install the motors and fans in the nacelles, you need to cut out and install the inlet and exhaust rings. I spray-painted the inlet rings silver first and used Pacer* Formula 560 Canopy Glue to attach the rings (I also used this on the nose cap and windshield). Again, a 2mm metric Allen wrench is required to lock the prop adapter to the motor shaft. One bolt and locknut hold each nacelle in place.

After running the fans, it was obvious that I needed to balance them. I used a Robart* High Point balancer for this. I used a small ball cutter in a Dremel to take away a little material inside the heavy side of the hub. Put a dot of paint or a scratch on the spinner and fan so that you can reposition them at the correct balance point. The fans are a tight fit on the adapter shafts, and when they're in place, they're nearly impossible to remove. To remedy this, I used a no. 36 bit to drill and tap two holes in the hubs from behind in opposite corners of the webs and the outside wall. To remove the fans, I screwed two long no. 6-32 screws into these holes and against the motor-mount face to push off the fan.

The kit contains four large sheets of stick-on graphics that you need to cut out with scissors. Use the photo on the box as a guide when you apply them. The fuselage stripe is the trickiest: place the stripe's top edge ¼ inch from the base of the windshield and

KYOSHO ELECTRIC LEARJET ARF

the bottom along the top crease of the wing fillet. I added stars to the wings to make my Learjet a pseudo Air Force C-21A.

A battery box is built in and is in the correct location to balance the Learjet, but the instructions don't tell how to mount the receiver or ESCs. I mounted an Airtronics 92777 receiver on 3/8-inch-thick foam tape and glued it to the inside top of the fuselage, in front of the servo mounts. I also mounted two Kyosho Sky Victory 210 ESCs and a Y-harness with hook-and-loop fastener and positioned two, 8.4V, 2400mAh battery packs side by side in the box that's built into the fuselage. These are of higher capacity and are heavier than the recommended 1700 to 2000mAh packs, so I placed them 2 inches farther back for proper balance and put a Styrofoam block in front of them. I usually don't remove the batteries to charge them; this slows down turnaround, as they should be allowed to cool after a flight. I changed the ESC and battery connectors to Sermos* connectors to match my charger leads and made an adapter to put the packs in series so I could charge them at the same time. My Hitec* CG-335 will charge the 14 cells at 5 amps with ease.

Before flying, I did range checks with the motors off and running from slow to full power. I painted half the spinners white so that I could take tachometer readings (just to satisfy my curiosity; it's difficult to tell how fast they're turning by ear, as they sound so different from a glow-powered fan). With a fresh charge, they turned 11,000 and 11,200rpm—rather slow for ducted fans.

BUILDER'S THOUGHTS

This is a very good model, and its performance and speed were what I had expected. The Learjet won't keep up with a glow-powered ducted-fan model, but it was never intended to. For increased performance, I'm sure that many will hop up the Learjet with high-performance brush and brushless motors, as has been done with the Kyosho T-33 and F-16. My model's performance may suffer a little by flying with the tip tanks in place, but they do look good! Control throws and balance point as shown on the plan suited me, and I found the Learjet to be very relaxing to fly without any bad flight traits. Although the instructions have good drawings, the text is lacking in spots, and the assembly sequence is, at times, not logical. Overall, the kit itself is well thought out and manufactured .... I hope there's an A-10 in the future!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✚

MODEL AIRPLANE NEWS
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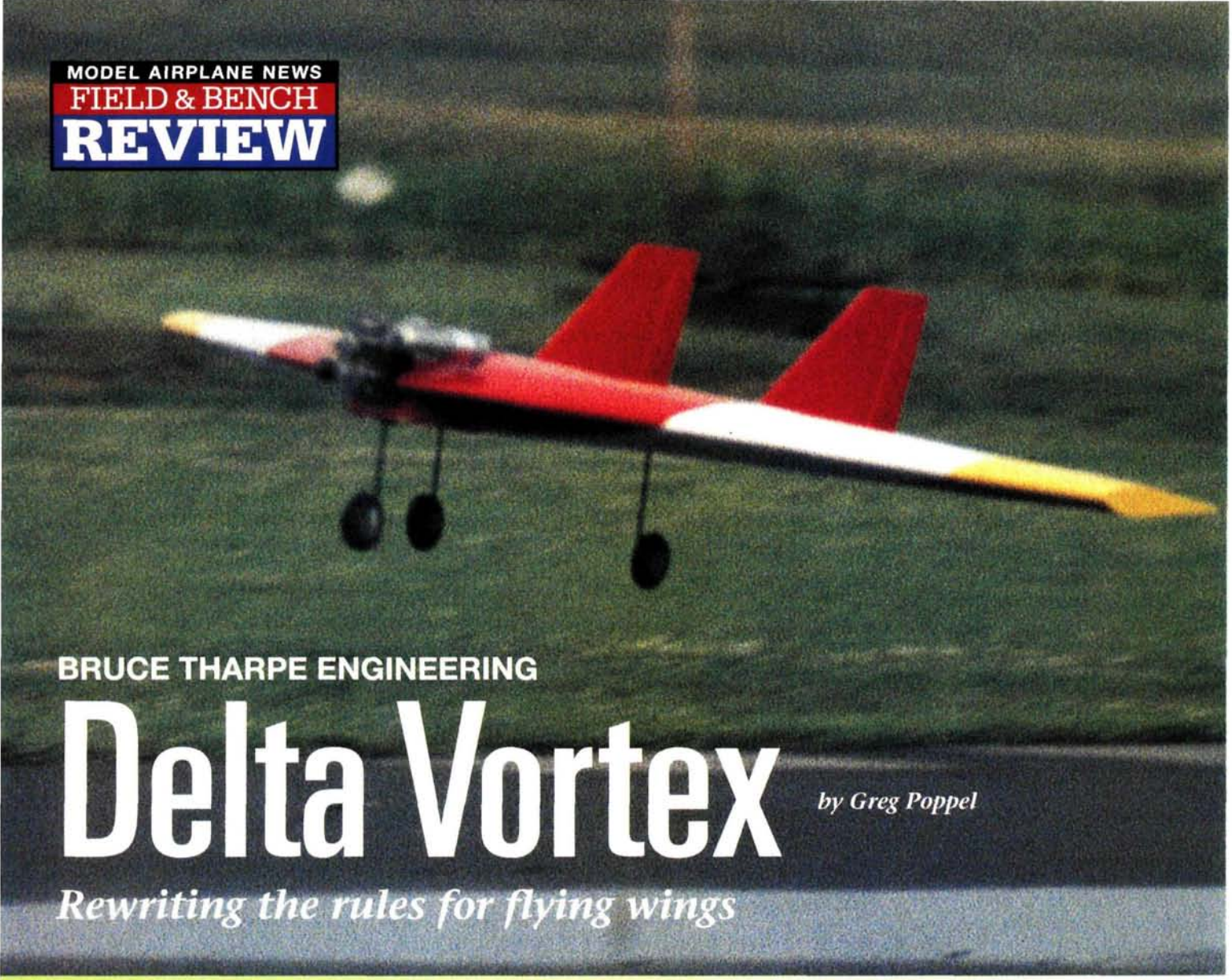
REVIEW



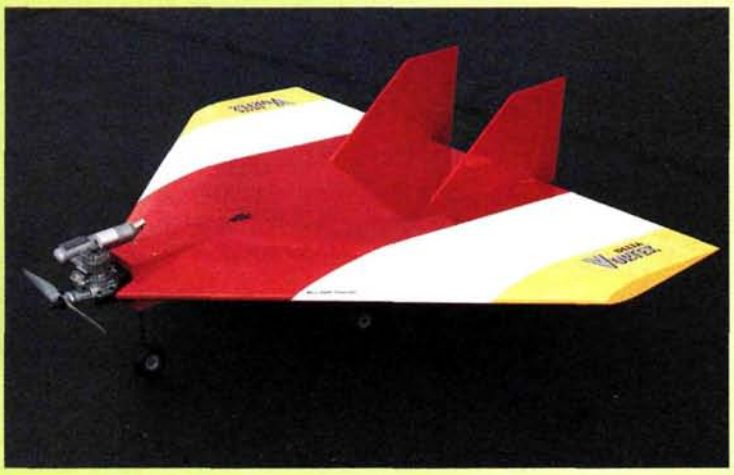
BRUCE THARPE ENGINEERING

Delta Vortex

by Greg Poppel

Rewriting the rules for flying wings

Deltas have been very popular as RC subjects, but most were designed for speed. I wanted something *different—a delta that was designed for aerobatics* and could be flown like a normal sport model. The Bruce Tharpe Engineering* Delta Vortex is such a model, and it may change how deltas are perceived by the RC airplane community.



SPECIFICATIONS

Model: Delta Vortex

Type: sport delta wing

Manufacturer: Bruce Tharpe Engineering

Wingspan: 54 in.

Wing area: 1,375 sq. in.

Weight: 7 lb., 4 oz.

Wing loading: 11.9 oz./sq. ft.

Radio req'd: 4-channel with 5 or 6 servos (rudder—1 or 2; throttle; elevon—2; steering)

Engine req'd: .60 to .91 2-stroke or .80 to .91 4-stroke

Engine used: O.S. .91FX

List price: $120

Features: high quality machine-cut balsa, aircraft plywood and lite-ply parts; prebent landing gear with wheel collars; Sig and Du-Bro hardware; excellent CAD-drawn plan; photo-illustrated instructions.

Comments: I really liked the completeness of the kit and the detailed instructions. Once built, this model is very responsive and stable—even at slow speeds—so it's uncommonly easy to fly, especially for a delta wing.

Hits

- High-quality wood selection.
- Great plan makes it easy to build.
- Stable and responsive flight.

Misses

- None.

FLIGHT PERFORMANCE

Intermediate pilots who are experienced with low-wing, 4-channel sport models shouldn't have any problems flying the Delta Vortex. If it is warp-free and balanced properly and has a good radio and a reliable engine, your first flight should be successful.

The word that best summarizes the Vortex's flight characteristics is "neutral." With its symmetrical airfoil and the engine centered on the wing, it wants to go exactly where you point it. Although not designed for speed, it moves well at full throttle. Its most amazing flight attributes are displayed at low speed. As long as your tail weight is secure, you'll enjoy its honest control response and soft, nose-high landings.

TAKEOFF AND LANDING

The Vortex has all of the characteristics of a trainer: it won't tip stall so takeoffs and landings are a breeze. Takeoff is straight down the runway and smooth into the air.

Landings are very amusing; you can set your approach very high and let it settle into the runway hands-off; the glide slope is that flat. Some trainers don't handle this well.

SLOW FLIGHT

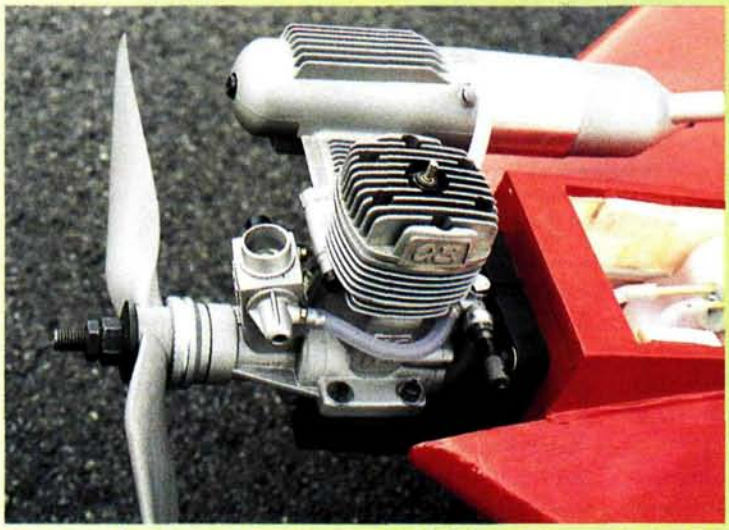
This is the Vortex's strong point. With the O.S. .91 we could set about two clicks above idle and fly all day long with no sign of a tip-stall.

AEROBATICS

Loops, rolls and even stall turns are very smooth. The dual rudders make it easy to do point rolls, but snaps are very large because the Vortex is so stable. Partial knife-edges (commonly called butter-knife-edges) are possible, but they aren't quite at 90 degrees.

CONSTRUCTION

The subassemblies are somewhat time-consuming to complete, but they ease assembly later. Build two fins using the four balsa pieces labeled fin 1 through fin 4. Use yellow glue so that the joints will be easy to sand later. Sand the leading edges (LEs) round, but leave the other edges square. Glue two scrap, 1½-inch-long pieces to the rear edges of the sub-fins, and trim the pieces to match. Drill and groove the sub-fins to accept the prebent 3/32-inch tailskid wires. Clean the wires with sandpaper and alcohol, then epoxy them into place. Cut the supplied fiberglass tape in half, then glue the halves to the sub-fin using epoxy or thin CA. Wrap the tape around the bottom of the sub-fins to hold the tailskids in place, and trim away the excess. Mark the bottom edge of the balsa fin sockets using the small parts diagram shown on the plan. Cut one of the spar scraps in half, then glue the halves to the sides of the fin sockets and trim them. Inlay a plywood control-horn pad into one side of each balsa rudder. Carefully cut the 1/16-inch-deep recesses for the pads, then glue them into place. Drill two 3/32 inch holes for the nylon rudder-control horns and harden the edges of the holes with CA. Cut rectangular holes for your servos in the lite-ply elevon-servo mounts. Make sure they are centered and are large enough to allow 1/16 inch clearance around the servo. Add 1/8-inch lite-ply reinforcements to each servo mount. Make one or two cutouts in the lite-ply rudder-servo mount (the number of cutouts will depend on which rudder-servo option you choose).



The engine installation is straightforward. This O.S. .91FX provided plenty of power for the Vortex; it cruised happily at just a couple of clicks above idle.

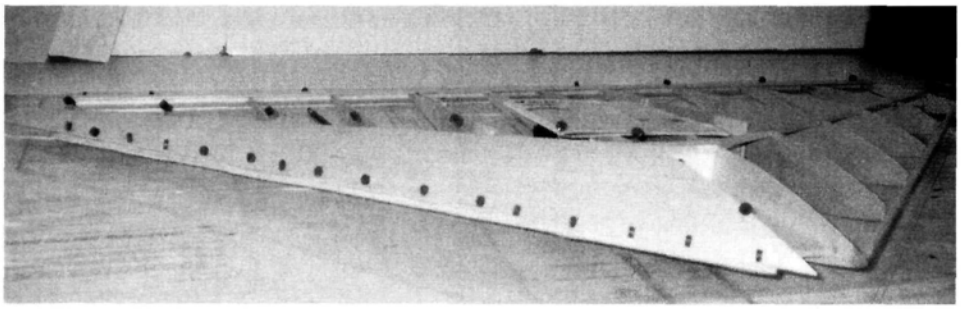
The Delta Vortex airfoil is symmetrical, but the wing ribs have a definite top and bottom. Clearly mark the bottom edges of all the ribs to avoid confusion later. Glue two lite-ply landing gear (LG) plates to each W-2 (one plate on each side); be sure that the notches for the LG block are lined up. Glue an LG plate to the outboard side of each W-1 rib (make one left and one right). Cut 8¼-inch-long pieces from each of the basswood sticks and glue them to the sides of the W-1 ribs between the LG plate and the notch for the rudder-servo mount. Accurately mark the position of F-2 on the inside surfaces of the two W-1 ribs. Align the front of F-2 with the front edges of the spar notches.

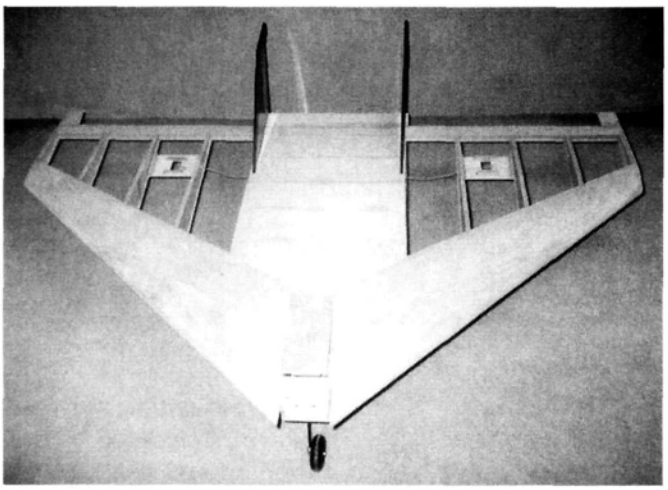
WING ASSEMBLY

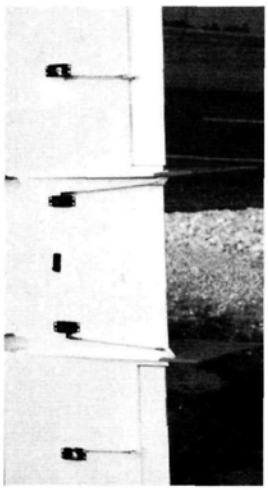
Pin the trailing edge (TE) on the plan, and trim off the excess material at each end (note the position of the splice between the sheets). Glue all of the ribs to the TE, and pin each to the building board (be sure they're square). Glue an 1/8-inch lite-ply spar strap to the top of the ribs. Be certain that the beveled ends of the spar strap face upward. At this point, the ribs will seem weak and fragile; don't worry because as more parts are added, your wing will become stiffer and more rugged. Trial-fit the wing spars, then glue them into place. Cut a piece of plywood that will fit between the main ribs and will serve as the front edge of the radio compartment. Bevel the front ends of all the wing ribs, and glue the two LEs to the fronts of them. Bevel the top edges of both LEs to match the angle of the ribs. Glue the fin-socket assemblies into place as shown on the plan; temporarily unpin the TE, then glue the sheeting into place and repin the TE firmly to the building board to keep it straight.

Next, install the two top LE sheets. Trial-fit them to the wing and start gluing. Add balsa capstrips to the tops of the ribs. Now you really get a sense of the size and lightness of the wing! This is a good time to go back over all the glue joints with medium CA. When you've finished, you should be able to see a small buildup of glue on both sides of every joint.

Trim the LE sheeting along its front edge,







Top: once you've constructed all the subassemblies, construction goes quickly. Here, the LE sheeting is being installed (use lots of pins to hold everything securely). Above left: the finished airframe, ready to cover. The absence of a fuselage makes covering the Vortex quick and easy. Above right: the linkage and servo setup is visible on the wing's underside. Separate servos are a must for the flying wing.

leaving about a 1/16-inch overhang (this will be sanded later). Pin the wing upside-down to the board and add the bottom sheeting. Use plenty of glue now; you won't be able to go back and reglue these parts after you've applied the bottom center sheeting. Now it's time to add the plastic antenna tube. Wipe it with alcohol, slide it into place, then glue it at each rib with medium or thick CA. Cut six shear webs out of your scrap balsa (make sure the grain runs vertically), then glue them to the front edge of the spars. Glue the bottom TE sheeting into place, this time, with the splice on the opposite side of the splice in the top sheeting. Epoxy the grooved basswood LG block into the notches in the four wing ribs. Attach the center sheeting to the wing's bottom surface in two pieces—one fore and one aft of the gear block. Glue the two elevon servo mounts so that the rear edge of each is 4 inches forward of the TE.

FINISHING THE WING

A piece of balsa is provided for sheeting the elevon-servo mount. Carefully trim and sand the LE sheeting flush with the LE. Glue the two balsa LE caps into place. Carve the cap approximately to shape, and then round it using a long sanding block. Sand the TE so it's square with your building board. Glue the two tapered balsa elevon tips and the fixed center elevon piece to the wing TE. Trim and sand the sheeting, the spars and the LE and TE at each wingtip. Glue the two lite-ply wingtips into place, then sand them to match the wing contours. Cut two elevons out of the tapered and beveled elevon balsa provided. Now final-sand the wing; avoid sanding the sheeting as much as possible.

ENGINE AND RADIO INSTALLATION

This design doesn't have a true fuselage, but it does have an engine box for the engine, the fuel tank and the steering and throttle servos. Draw the centerline and thrust line on the front of the firewall. While holding the engine mount in place, mark the four mounting holes. Temporarily bolt the engine to its mount, then mark where the throttle pushrod will pass through the firewall. Position the nylon nosewheel bearing and mark the locations of its four bolts. Glue the two 1/8-inch lite-ply engine-box doublers into place; be sure to make one left- and one right-side doubler! Now glue the engine-box sides to the main ribs and to the box top. Cut and epoxy into position two braces to reinforce the joints between the box doublers and the firewall. Use foam padding to position your fuel tank as close to the box top as it can go. Mark the firewall where the fuel lines come through, drill the necessary holes, and install the fuel tank.

I used an O.S.* .91FX because of its power and reliability. The largest diameter prop that can be used is 14 inches, and I used a 2 7/8-inch-diameter spinner.

Depending on whether you use single or dual rudder servos, you will need a 4-channel radio with elevon mixing and five or six servos. Standard servos are fine for all but the elevons. We chose the Hitec* HS-945 with 150 oz.-in. of torque. If your radio doesn't have elevon mixing, you can use a simple aftermarket electronic mixer.

FINAL ASSEMBLY

The fins and wing must have a firm wood-to-wood joint, so use slow-drying epoxy. Before the glue sets, be sure the fins are square to the wing. Repeat for the two subfins. Hinges are supplied for all of the control surfaces. Fasten both of the LG wires to the gear block, and attach the main wheels to the wire with wheel collars. Use machine screws to attach a nylon control horn to each rudder. Cut the two servo rails, and mount the steering and throttle servos on them. Cut a nosewheel steering cable. Bolt your engine and its mount into place. Route the throttle cable from the carburetor's control arm to the throttle-servo arm. Mount all of your elevon and rudder servos. I mounted the switch and charging jack on the plywood radio hatch to protect them from the engine exhaust.

BALANCING THE VORTEX

Because the engine is so far forward, you will have to add weight to the tail to balance the Vortex, so don't try to save weight at the back. I recommend a lead-shot/epoxy mixture so the weight will remain firmly fixed. There isn't much in the nose structure that can be lightened; you need a sturdy nose to absorb the engine vibration. Owing to the wing's tremendous area, the effect of this extra weight on wing loading is negligible. Balance the model at between 21 and 22 inches from the elevons' TE.

CONCLUSION

I had a ball with the Bruce Tharpe Engineering Delta Vortex. Its steady, responsive controls and its slow-flight stability make it easy to fly and a real departure from the typical delta wing. I recommend it to anyone who has kit-building experience. This is a great design and a high-quality kit that any modeler will enjoy. If you're looking for something a little different and a lot of fun, give the Delta Vortex a try.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✚

MODEL AIRPLANE NEWS
FIELD & BENCH
REVIEW

A relaxing backyard flyer

HOBBY PEOPLE

Watt-Age Lite Stik

by Roger Post Jr.

SPECIFICATIONS

Model: Lite Stik

Manufacturer: Watt-Age

Distributor: Hobby People

Type: park/indoor flyer

Wingspan: 38 in.

Wing area: 238 sq. in.

List price: $39.95

Weight: 6.6 oz.

Wing loading: 4 oz./sq. ft.

Overall length: 26 in.

Motor req.: 180 GWS motor w/dual ball-bearing gear drive (included)

Speed control used: Watt-Age IC-55A ESC

Propeller used: GWS EP 10x4.7 (included)

Battery req'd: 6- to 7-cell 110mAh flat pack

Battery used: Watt-Age 6-cell, 110mAh, 7.2V flat pack

Radio req'd: 3-channel w/two servos

Radio used: Hitec* Prism 7X w/Feather receiver and Cirrus* CS-10BB servos

Features: one-piece wing halves and tail surfaces made of stiff, closed-cell foam; a stick fuselage; wheels; 180 GWS motor w/dual ball-bearing, 8.6:1 gear drive attached; GWS EP 10x4.7 propeller; spinner; assorted hard-

With Hobby People's* introduction of the Watt-Age Lite Stik, I believe the "stick" concept has proven to have about as many lives as a cat. From the original Das Ugly Stik to the recent Ultra Stick, a generation of modelers has learned to fly and has had fun with these airplanes. Now with the Lite Stik, modelers can enjoy flying in confined outdoor areas or indoors.

PHOTOS BY WALTER SIDAS

The Lite Stik reminds me of the rubber-band airplanes I used to buy for 15 cents in the '60s. The fuselage is a 22-inch-long, 3/8x1/4-inch stick; however, construction of the wing and tail surfaces has been updated: they are made of stiff, closed-cell foam instead of balsa. The landing-gear wire will bring back some memories, and the custom, spoked, ultralight wheels look really neat. The rubber-band motor has been replaced by Grand Wing Servo's new, geared, cored 180 motor, and thanks to the micro RC world, these stick models can now be guided around the sky or the gym.

ASSEMBLY

After thoroughly reading the instructions, go back for a second look at the photos. Note the orientation of the servos and their arms to the fore and aft sections of the fuselage and the wing's fore and aft mounts.

The first step is to cycle the battery pack three to five times for maximum performance—go for five. (This is extremely important in the achievement of optimum flight performance during the first flight.) While you let the motor cool between runs, you can mount the tail surfaces.

If your fuselage is warped, soak it in a 50:50 solution of ammonia and water and lay it on a flat surface with some weights on it. I accidentally snapped the fuselage in half when I tried to bend it by hand, but I simply glued it back together with a straightedge running down its length as a guide.

Mark the fuselage and horizontal stabilizer as shown in the instructions, then draw a line along the

ware; decals; instructions; glue.

Comments: you can easily assemble the Lite Stik in one evening. It is very stable and quite docile—a great model to relax with.

Hits

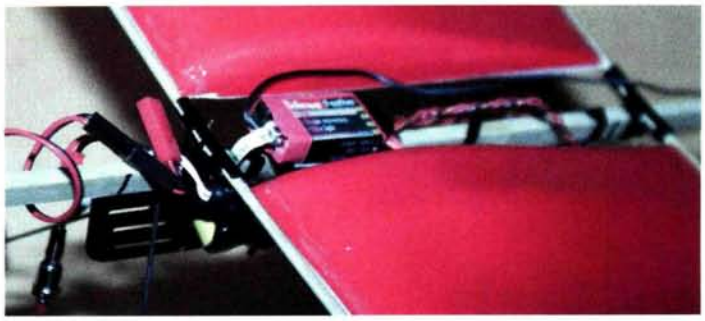
- Lightweight construction design.
- Assembles quickly.
- Good flyer with low-speed flight characteristics.
- Good quality on all parts.

Miss

- Fuselage stick slightly warped.

hinge lines of the elevator and rudder that have been cut into each stabilizer. Flex the control surfaces on these lines (no more than 45 degrees) to create the hinge. Ensure that there is equal deflection in both directions; if there isn't, run the pen down the hinge line again. You need to create a "V" in the line so the control surface can achieve its full deflection. (This will help later when you try to turn.) On each stabilizer, note the orientation of the slot for the control-surface horn. Glue the horizontal stabilizer into place with the provided special glue that dries in 20 minutes.

While you wait for this to dry, you can attach the wing dowels to the leading and trailing edges of each wing half. The long dowels go on the leading edge, and the shorter dowels are for the trailing edge. Each dowel is glued into place and then secured with a piece of clear tape from the decal sheet (cut these out before you glue the dowels into place). This should take all of 20 minutes, and when you've completed these steps, go back to the fuselage and glue the vertical stabilizer into place.



A Feather receiver (from above) and two Cirrus CS-10BB servos were used to guide the Lite Stik. The ESC is directly under the receiver.

FLIGHT PERFORMANCE

Be sure to cycle the battery the required five times. I tried to fly the Lite Stik with a battery that was charged only once—not a good performance.

• TAKEOFF AND LANDING

With a 10-foot takeoff roll, the Lite Stik will effortlessly ROG from a paved surface. My model veered to the right during the takeoff run, so I used a little left rudder to keep it straight. I also fed in some down-elevator to get the tail to come up. The Stik can also be hand-launched with full power. The climb-out for either method is slow, so be patient. To achieve a hands-off climb, I had to add some up-trim. In straight and level flight, no directional trim was required.

To land the Lite Stik, gradually reduce the power and flare it in for a soft, 3-point landing. At the moment of touchdown, cut the power. I found that if you kill the power a foot or two above the ground, the model will dive to a landing—very hard on the propeller and its shaft.

It taxis quite nicely on pavement or the smooth infield of a baseball diamond. You can blast it along at full power, raise the tail and "drive" it to wherever you want it to go.

• LOW-SPEED PERFORMANCE

I think this heading sums it up quite well: the Stik is slow, and it only likes to fly in the slightest of winds. I found myself leaving the throttle at full power and just lazily flying the Stik around the field for about four or five minutes. At one point, I was able to attain some altitude, so I cut the throttle and trimmed the Stik for level flight. Although it descended a little faster than I expected, it has a decent glide ratio. It likes to fly with the power on.

Stalls were quite tame; but when it stops flying, the Lite Stik needs some room to recover. Don't stall it close to the ground.

• AEROBATICS

I've heard that some folks were doing both inside and outside loops with the Stik, but they either had hotter motors or 7-cell battery packs. I wasn't able to gain enough altitude or airspeed to do much more than a wingover/stall turn or a change in the direction of flight.

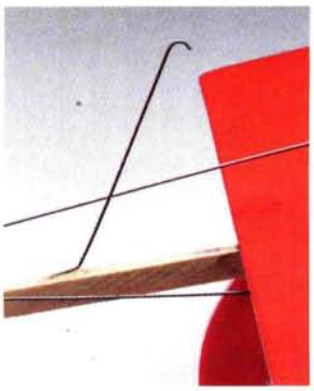
Many Stik owners have used some non-stretch string and some thin dowels or sticks to create some dihedral in the wings. The dowel/stick acts as a center post at the CG, and the strings run between the post and the wingtips. Once the string is connected to the wingtips, it is then pulled slightly—to add some tension—and attached to the center post. This modification allows the Lite Stik to turn better with its rudder-only directional control.

I have found that if you ensure that the rudder deflects at least 40 degrees to either side, the Stik will turn on its own quite well without this modification. Sometimes, I add in a little down-elevator, which drops the wing and allows the model to turn, but this usually happens when the model is going downwind.

Assemble the landing gear as instructed, and cut all required plastic parts from their "trees." Note that there are two front wing mounts: the taller one provides a higher angle of attack for better slow-flight characteristics. The landing-gear wire is pushed into the slot directly underneath the wing-dowel receptacles of the front wing mount.

Mount the vertical stabilizer, and after the glue has dried, slide the pushrod guide, the rear wing and servo mounts, the battery tray and the front wing mount (with landing gear installed) onto the stick fuselage. Attach the servos and servo arms and orient them as shown in the photos.

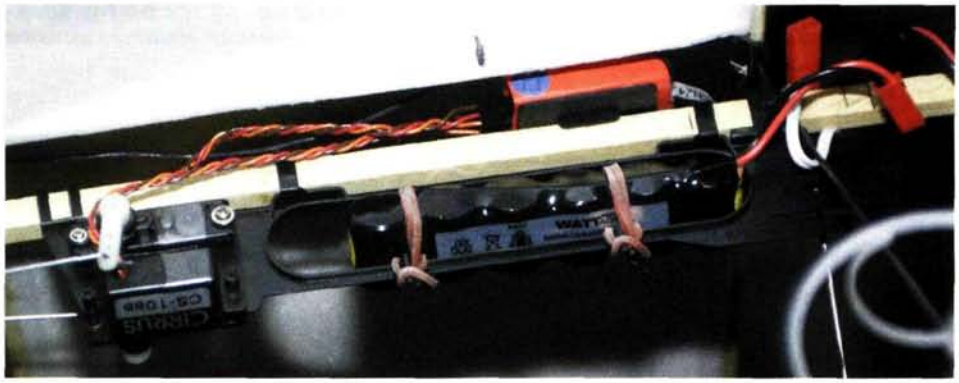
Before attaching the tailskid, I increased the angle of the bend near the fuselage to 90 degrees, then I measured ¼ inch from this bend and bent the tailskid wire down to form the required tailskid. This ¼ inch provides the wire with more contact area on the fuselage bottom and, when it is glued into place, this modification prevents the tailskid from pivoting in the predrilled hole.



To prevent the tailskid from rotating, I bent an extra length of wire and then glued it onto the fuselage stick.

[Editor's note: the manufacturer has also made this modification to subsequent kits.]

Now attach the motor/gearbox, the propeller and spinner and the remaining radio gear per the instructions (don't glue the receiver mount into place at this time). Attach the control horns to the rudder and elevator (note the placement), and install the pushrods to the



The Lite Stik's radio installation is simple; everything is attached to one of the three plastic parts. The larger GWS piece accommodates the battery and the forward portion of the servos, while the smaller piece secures the aft portion of the servos. The receiver is mounted on a plastic tray via double-sided tape, and the tray is glued into position after the Stik has been balanced. The dark mark on the underside of the wing is the CG location.

control horns; slide the wires through their respective holes in the pushrod guide.

With great care, attach the wing panels to their forward and rear mounts. The dowels fit very tightly in the slots, so push them in gently to avoid snapping a wing panel in half. Then apply your decals of choice.

FINAL TOUCHES

Mark the CG point under each wing panel, and check the Lite Stik's balance. If it is tail heavy, slide the wing mounts aft. (You might have to slide the battery tray and rear servo mount aft, as well.)

After you have balanced your model, turn the radio on and center the servo arms. Bend, cut and attach the wires to the servo arms as per the instructions. You might have to move the pushrod guide back to help support the wires. The instructions are quite clear as to servo placement and control-arm movement, so there should be no need to reverse the servo directions. Double-check to ensure that up-elevator is up-elevator and right rudder is right rudder, etc. Now press the motor safety switch, and test the motor with the propeller attached. Hold the model while you do this because the motor and propeller do generate some thrust.

After one more check of the model's balance, glue the receiver mount into place. Your Lite Stik is now complete.

The GWS motor/gearbox is pushed all the way onto the fuselage stick. If the fit is tight, lightly sand the top, sides and bottom of the front area of the fuselage to achieve the desired fit.

BUILDER'S THOUGHTS

You should easily be able to assemble the Lite Stik in one evening. Although it is made out of somewhat sturdy materials, I would exercise caution when handling it during its construction and subsequent storage.

The Lite Stik is a good model for newcomers or for anyone who wants to fly in a smaller area or indoors. Overall, it's a fun little airplane to cruise around with when the wind is light. I recommend it to beginning modelers, young and old. For seasoned pilots, flying the Lite Stik is a great way to relax at the field or in your backyard. Get one and join the fun!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✈

A simple technique for super results

Spray-Can Painting Made Easy

by Gerry Yarrish

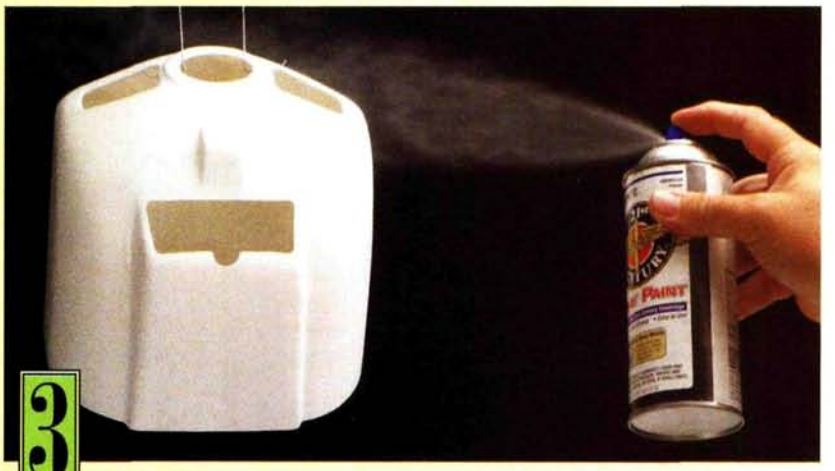
When you start building models that have formed plastic or fiberglass parts such as the engine cowl, wingtips, or wheel pants, you are faced with the additional task of painting them to match the rest of your model. Spray paint is a convenient and simple way to paint those formed parts, but unless you take the time to prepare them, your new paint job can peel or chip away after only a few flights. Here's a sure-fire way to achieve a long-lasting, attractive paint job with a minimum of effort.

Basic things you'll need include 150- and 220-grit sandpaper, vinyl electrical tape and paper masking tape, a sharp hobby knife, paper towels and denatured alcohol. You'll also need masking paper (wrapping paper or doubled-over newspapers) and an automotive tack cloth. Whenever possible, use the same brand of paint, primer and clear coat. Here, I am using Coverite* 21st Century white, iight red, white primer and glossy clear.

1 The first step is to wash your hands to remove any body oils from your fingers before you begin sanding your part (here, an engine cowl for my Giantscaleplanes.com Super Decathlon). Sand with 150-grit paper, and remove all the parts' surface gloss. Get into all the small corners, and smooth the inside edges of any openings.

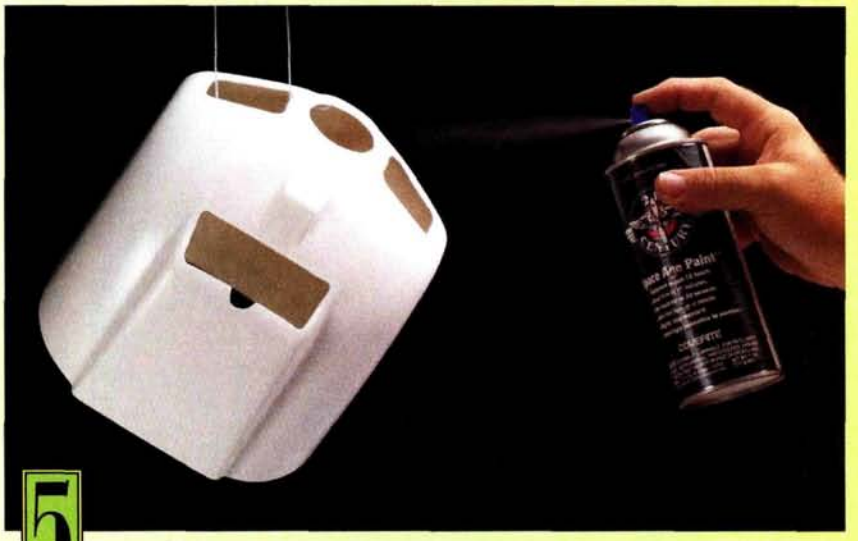
Wipe off the part, and check to makes sure that there aren't any shiny spots. Then sand the cowl again with 220 sandpaper. Sanding the part gives the primer something to "bite" into and helps the finish adhere to the part.

2 Wipe off the cowl again and then use denatured alcohol to degrease its surface. Even fingerprints can cause the finish to peel.



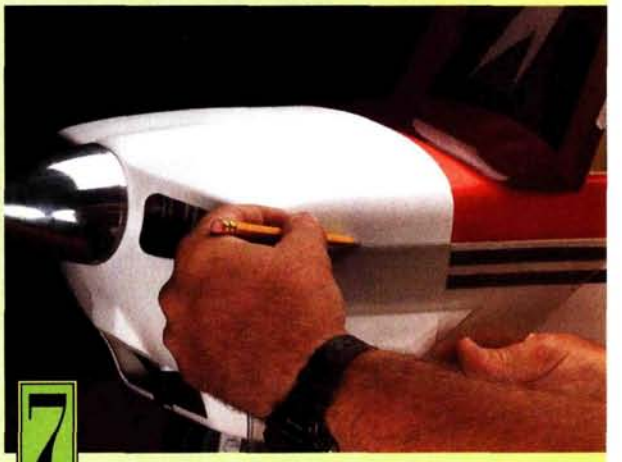
3 Before you spray on the primer, make a hook out of a wire coat hanger to hang the part on. Shake the can vigorously until you hear the little mixing ball rattle, then apply the primer in several light mist coats. Allow each coat to dry for a minute or two before you apply the next. While spraying, hold the can about 10 to 12 inches away from the part.

4 After the part has dried for a few hours, wipe it down with a tack cloth to remove any dust from the surface. When handling the part, try to hold it from the inside to minimize finger marks on the outside.

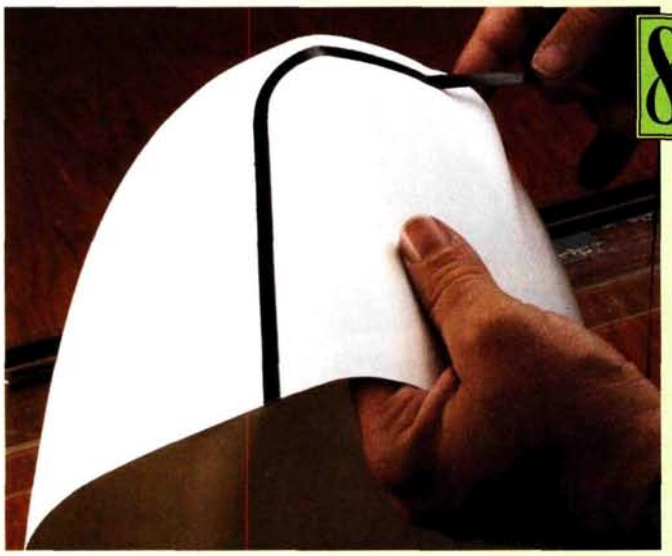


5 Hang the part again, and start applying the base coat—in this case, high-gloss white. Whenever you paint a multicolored part, always start with the lighter colors and add the darker on top. Also, if you paint a single, bright color such as yellow, orange, or red, apply a white base coat to the part first; this really makes the color coat shine.

6 Prepare your masking tape by cutting the electrical tape into thin ¼-inch strips. The upper red portion of my engine cowl has two rounded front corners that require the masking tape to be bent around them. Thin strips make this possible.

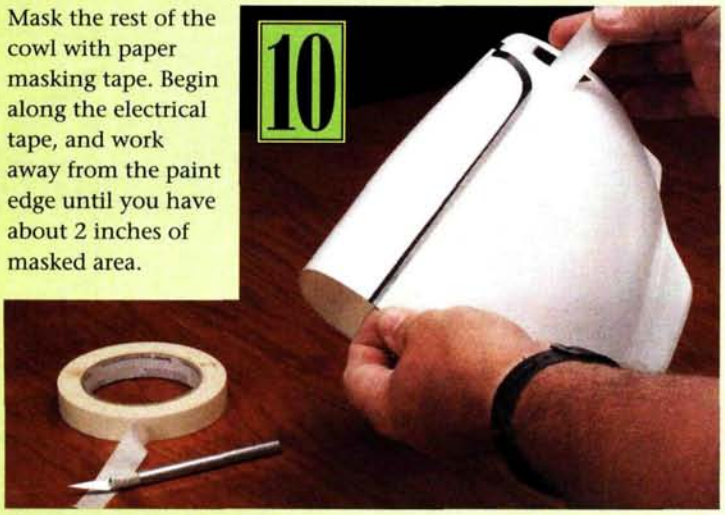


7 After the paint has dried overnight, place the cowl on the model, making certain it's positioned correctly relative to the spinner and firewall. Use a straightedge to draw light pencil guidelines so the painted portions will match the trim design on the fuselage.



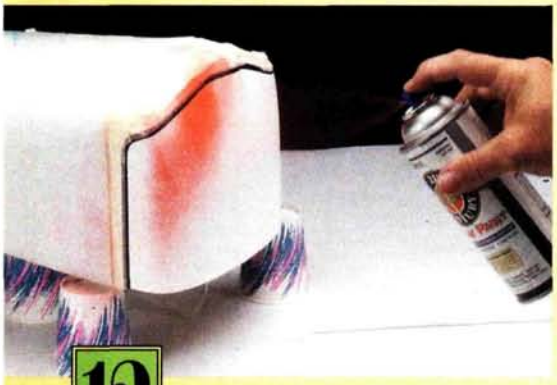
8 Using the guideline as a reference, apply the electrical tape to the outside or "masked" side of the guideline. Do not stretch the tape along straight lines, and only stretch it lightly along curved edges. If the tape is stretched too much, it will lift before you have finished painting the part.

9 Check the tape to make sure it's correctly positioned. If you don't like it, remove it and reapply it until it's right.



10 Mask the rest of the cowl with paper masking tape. Begin along the electrical tape, and work away from the paint edge until you have about 2 inches of masked area.

11 Use paper to mask the rest of the cowl, and make sure everything is completely covered. Use your thumbnail to burnish the electrical tape down tightly. Double-check the curved edges to make certain the tape hasn't lifted out of place.



12 **Above left:** cover your work surface with paper, and prop up the cowl with a couple of paper cups to lift it from the bench. This will prevent the paint from "gluing" the part to the paper and marring the finish. Now apply the trim color to the unmasked portion of the cowl. Apply the paint in very light mist coats, and allow it to dry for a minute or two before you apply more paint. **Center:** here, you see the first mist coat. Note that it does not completely cover the white base coat. Apply several more light coats until the white is no longer visible. **Above right:** this is what the red looks like after six or seven mist coats have been applied. Now let the paint set for about 10 minutes, then carefully remove your masking tape.

13 After the paint has dried overnight, apply your trim graphics. Here, I am applying the black star to the cowl. Note the small triangle of white I added to the top point of the star. This little trick makes it unnecessary to mask off the red portion where the star would rest.

14 Here, I am applying the two black pinstripes that finish the trim design. Once you have finished with all the trim work, wipe the cowl with a tack cloth and hang it on the wire hanger again and apply several light clear coats to seal everything into place. Allow the clear coat to dry overnight, and you'll be ready to attach the cowl to your model.

Here is the finished cowl on the Super Decathlon. Painting with spray cans is very easy, and the results are impressive if you take the time to do the job right. A clear coat really makes the finish shine and seals all the trim edges at the same time. Give it a try; you'll love the results.

*Addresses are listed alphabetically in "Featured Manufacturers" on page 198.

by Bob Benjamin

Electric Power for Scale Models

Clean, reliable and vibration-free

Modelers around the globe have proven that electric-powered RC scale airplanes can be made to fly as well as their engine-powered counterparts. For all but the very largest, propeller-driven scale models, an electric motor can deliver the same power as a gas or glow engine. The problem is that the "power density" of electric systems is not as good as that of engines, i.e., electric systems weigh more and may offer shorter flight duration than engines of equivalent power. Although electric models cannot yet match fuel-powered models in every aspect of performance (battery packs are still heavier than fuel tanks), by choosing an appropriate subject and using the straightforward guidelines presented here, you can be assured of a scale model that will perform just as well as it would with an engine up front. These guidelines also apply to sport models, from trainers to sport aerobats.

The author's ¼-scale Taylorcraft at Top Gun. The 108-inch-span, 22-pound model is powered by a geared Astro 90 and uses a 36-cell, 3000mAh Ni-Cd battery pack; it has a max flight duration of over 15 minutes.

ADVANTAGES OF ELECTRIC POWER

E-power has many advantages; most obvious is its quietness. There are, however, several other very good reasons to use electric power, all of which relate to improved appearance and better, more consistent flight performance.

• **Electric power is clean.** This eliminates all of the problems of fuelproofing and all concerns related to post-flight cleanup without destroying surface detail.

• **Electric power is efficient.** Motors, operating through gear or belt reduction drives, are quite efficient for turning propellers that are very close to scale diameter. This is an advantage we enjoy only with electric motors and points out a shortcoming of model engines: they work best at high rpm (no practical means has yet been found to mass-produce reduction drives that will allow engines to turn big, slow props). Motors can be run flat-out on direct drive to turn small props at high speeds, but experience has confirmed that for the majority of sport and scale models, it's more efficient to turn big props at relatively low speeds (3,500 to 7,500rpm). Using a belt or gear speed-reduction drive with a motor is simple because the power transmission is free of vibration. What might appear to be a second-rate fix is actually a very efficient use of power. Keep in mind that in full-scale turboprop engines, a gas turbine (jet) is geared down to turn a big propeller at a practical rpm. As with our model-size motor system, the turbine works best going fast, and the propeller works best turning much more slowly.

• **Electric motors fit better in scale models.** We can build exact scale fuselages and engine nacelles that are never marred by protruding cylinder heads or mufflers.

• **Electric power is practically vibration-free; an obvious advantage for radio systems.** Electric power in all of my airplanes has allowed me to fly for years without any radio problems.

• **Electric power is convenient.** Moreover, you no longer need access to refuel, touch the glow plug and adjust the needle valve. You can also say goodbye to the problems of poorly adjusted mixtures that put you at risk of engine failure at idle. In fact, after you've set up an electric installation on the bench, you never need to adjust it, and starting is always automatic and immediate. At the field, you just charge the motor battery, turn on the radio and power switches, throttle up and fly.

GOOD E-POWER AIRPLANE SUBJECTS

Why do so many of the really successful electric scale jobs seem to be Golden Age planes? We have to accept that electric power systems still weigh more than engines of equivalent power, and they require careful power management (throttle use) to get really good flight duration.

The graceful airplanes of the '20s and '30s, WW I airplanes, classic light planes and many early WW II military planes relied on a lot of wing area to get good performance with engines that weighed a

lot for the power they provided. Our electric-powered scale models will usually have the best possible mix of climb, speed and duration if we build designs that have generous wing areas and moderate flight speed expectations, and choosing from the wide range of those Golden Age subjects just about guarantees good results.

You can build an all-out heavy-metal fighter, fully equipped with flaps, retracts and a scale, paint-based finish and fly it with today's electric power equipment, but the margin of performance necessary to make a practical competition model or sport-scale plane that's relaxing to fly is used up pulling that high-wing-loading airplane at the speeds we expect from fighters.

PREDICTING PERFORMANCE AND PLANNING FOR SUCCESS

Unfortunately, very few scale models intended for electric power are on the market in either plan or kit form. This means that unless you design your own, you will probably have to convert a glow model to electric power. The following procedures will eliminate the mystery and guide you through this process with a good chance of success. The same considerations apply if you develop your own plans for an electric-powered scale model.

Let's begin by picking a subject. With our Golden Age guideline in mind, choose a design that provides a head start toward success. Most vintage subjects dictate a performance envelope that can easily be met without pushing the limits of your electric power system. Unless you choose to build something like a Thompson Trophy racer, you will be able to cruise around the sky at moderate speeds and be "right in scale." No subjects are perfect, however; biplanes have low wing loadings but usually have external bracing struts and wires that add drag and force you to cruise at a high power setting, and low-wing planes are usually free of struts and wires but characteristically offer less wing area. All choices demand compromises, so pick the subject you like best and plan how best to deal with its good and bad characteristics.

AN ALTERNATIVE APPROACH

When I began building e-powered scale models with the intent of flying them in competition against "traditional" engine-powered models, I made the decision to use the same fiberglass, fabric and paint finishing methods as other scale competitors and to discover or invent ways to use those materials in the lightest possible manner and make my e-powered airplanes

This 1/4-scale Dynaflite Bowers Fly Baby was converted to use an Astro 40 with Superbox gearbox and 24, 2500mAh Ni-Cds for power. With lots of balsa substituted for lite-ply and other structural trimming, this is a good example of an electric conversion that weighs no more than the advertised glow version.*

The author's Sopwith Camel from the Proctor VK kit uses an Astro 25 and Superbox on 18, 2000mAh Ni-Cds. That scale-size prop is, in fact, the real flying prop; it's a 16x10. There's never any engine exhaust in the wires.

Tom Hunt converted this Kyosho Super Stearman from glow power to use a DeWalt 14.4V motor on a Modelair-Tech* H-1000 belt drive using 16, 2000mAh Ni-Cds. The converted model weighed only 1 1/4 pounds more than the glow version and performed well.*

fly well in spite of any small weight penalty that might be imposed by the finish work necessary to make them competitive. The record proves that I was successful at this, and the secret is nothing more than attention to detail and enough patience at every step of the way to "get it right" before moving on. Even my practice models use iron-on fabric with painted finishes on details such as cowls and landing gear to provide me with handling characteristics that are consistent with the "contest jobs." Many of you who are attracted to scale building and flying have no interest in competition, so you won't need to deal with the extra weight and complexity of "all-out" finishing and detailing. For non-competitive sport-scale flying, lightweight iron-on film coverings will work just fine, as will occasional structural simplification of cross-section or external detail. Any such changes from the approach I have chosen to take will result in small but significant savings in weight with consequent improvements in wing and power loadings for any given combination of airplane design and power installation.

SOME HARD FACTS

• **Wing loading**—the relationship between a model's weight and wing area—is perhaps the most critical factor in determining the success or failure of a scale model airplane. Regardless of power source, a too highly loaded model will be tricky to fly and dan-

Converted from an English kit intended for a 4-stroke, the author's 1/6-scale DH 60 Cirrus Moth uses a geared MaxCim 15Y brushless motor and 16, 2000mAh Ni-Cds for excellent scale-like flight with 10-minute duration and easy takeoff—even at 1/2 power. Full working exposed-rudder and elevator-cable controls are not compromised by the need to clean off glow-fuel exhaust.

This Spitfire was converted from the old Dynaflite kit and extensively modified to include scale retracting gear, flaps, cowl, canopy and an airbrushed epoxy finish. When the photo was taken, power was supplied by a geared Astro 60 on 32, 1800mAh Ni-Cd cells. This 15-pound fighter is a good example of an early WW II design that offers enough wing area to fly on e-power without compromising performance.

gerous on takeoff and landing. With a reasonable wing loading, you can usually modify and adjust other design characteristics to produce a good flying scale model. By choosing an older airplane subject, you can just about guarantee that it will have generous wing area, and if you keep its weight under control, you can count on a model that will be safe and enjoyable to fly.

If your plan or kit doesn't show wing area and wing loading information, you can easily work out the numbers yourself. Let's use a simple low-wing model, perhaps a PT-19 or DH Chipmunk, for our discussion. You can calculate basic wing area using simple geometry (area of a rectangle = length x width). Our sample airplane has a wing area of 1,300 square inches. Modelers usually express wing loading in terms of ounces per square foot of wing area. This can be expressed in square feet by dividing the number by 144 (1,300 ÷ 144= 9.375). Our model weighs 14 pounds. Convert this to ounces by multiplying by 16 (14 x 16 = 224). We divide ounces by wing area to get wing loading (224 ÷ 9.375 = 24.3 ounces per square foot). This is moderately light for a model of this size and will ensure gentle power off handling and easy flight at partial throttle settings.

• **Weight is something over which you have a lot of control.** First, choose a kit (or plan) that relies on careful engineering rather than material bulk for structural strength. Your next decision is whether to accept the manufacturer's judgment regarding material. You can save a lot of weight by replacing poorly chosen wood. Balsa weight varies; the heaviest you are likely to encounter weighs three times as much as the really light stuff. You want hard, straight-grain balsa for parts such as longerons and wing spars; the rest can be lighter. Spending a few extra dollars for light wood is well worth it.

So-called lite-ply, isn't! It is only marginally stronger than the balsa it replaces and is about three times as heavy. Use lite-ply parts only as templates. Replace parts such as fuselage sides with medium-weight balsa of the same dimensions, and replace highly stressed parts such as spar joints or formers with aircraft-grade ply that's one size smaller, e.g., replace 1/8-inch lite-ply with 3/32-inch aircraft ply. You may also be able to remove a lot of structural weight that isn't needed when you eliminate the vibration of a reciprocating engine. For instance, 1/4-inch balsa or 1/8-inch ply nose doublers might be replaced with 1/32-inch aircraft ply. Hollow out or make lightening holes in bulky nose blocks. Keep in mind the old adage, "Build to fly, not to crash," and remember that although the thrust and G-loads on an e-powered plane are the same as in a glow-powered model, all of the vibration-induced loads disappear.

Kits and plans nearly always advertise a finished weight. By following the procedures mentioned above, you can often finish an electric conversion of a kit intended for engine power with no weight gain. When the model's engineering is improved and heavy parts are replaced, I have even seen electric conversion models that were lighter than the advertised weight. In any case, by choosing a good kit and using good weight-control techniques, you should be able to do a conversion with a maximum weight gain of 10 to 15 percent more than advertised weight. You will also be safe in using such a postulated weight increase in your preliminary calculations to determine which power system to use.

Something very interesting happens with short-nosed airplanes such as those with radial engines. When you build engine-powered models of these airplanes, you usually need to add substantial weight to the nose to make the airplane balance at the correct CG position. My experience with several models of this type, including a Zero, Camel and Bearcat, has been that the weight of the motor battery, positioned as far forward as possible in the model, was sufficient to correctly balance it. I interpret this to mean that had I installed a glow engine, I would have had to add an amount of lead equal to the difference in weight between the glow engine and the electric system for proper balance. Just think: in those designs that would otherwise need substantial nose weight, there is no weight disadvantage for electric power!

SUGGESTED WING-LOADING VALUES

The standard wing-loading formula results in a non-linear relationship between aircraft size and wing-loading values. Because it helps to have a handle on performance characteristics, I have invented the "20s rule." It works for the great majority of models that have wing areas from 500 to 1,500 square inches. For scale models at the low end of the range, loadings in the low 20s are likely to result in gentle flight characteristics. Likewise, as wing areas increase to the high end, wing loadings in the high 20s will allow comfortable handling. For example, a light plane with 500 square inches of area would fly well with a wing loading of 21 or 22 ounces per square foot, while a 1/4-scale model of the same aircraft with 1,500 square inches of area would retain the same comfortable charac-

teristics with a wing loading of 27 or 28 ounces per square foot. Please keep in mind that this "rule" is only a general guideline.

POWER LOADING

Keith Shaw, an early pioneer of e-powered RC scale models, invented a power-loading rule that has been used by electrics modelers for years to determine the correct size of motor and battery pack to use in new models. Keith's rule uses the concept of input power to create an index number by which the power needs of various airplanes can be compared. This simply means that efficiency factors are disregarded; we use nominal battery-pack voltage and manufacturers' current ratings for motors. The rule works well as long as good installation and operating practices are used so that the equipment can function as designed.

The basic electric power equation states that power (watts) is the product of current (amps) and voltage. For example, 30 volts x 25 amps = 750 watts. Keith's power-loading rule tells us that for safe takeoff and cruise at reduced power, most models will need at least 50 watts per pound of model weight. For basic aerobatics, the same models will need 60 watts per pound, and for advanced aerobatics or fighter performance, 70 watts per pound or more will be needed.

CHOOSING A MOTOR

Use the power-loading rule, and examine the specifications published by electric motor manufacturers. A wide selection of small ferrite magnet motors is available from various U.S., Japanese and German manufacturers, and many of them are intended for the RC market. Although these motors can work well in smaller models if matched to appropriate reduction drives, many scale RC models will require larger motors, such as those manufactured by AstroFlight*, Aveox*, MaxCim* and Model Electronics*. These range from high-performance ferrite magnet products through top-quality cobalt magnet motors and the most sophisticated brushless designs. When you choose a motor, don't be swayed by names and model numbers that sound like glow-engine displacements. You should be concerned with the power output. Every manufacturer's catalog will provide enough information on any motor to determine whether it will meet your needs for a particular airplane.

Let's see how this would work for our sample low-wing model, which will do basic aerobatics but is not expected to have much vertical performance. According to Keith's formula, 65 watts per pound should provide suitable power for the performance we want. If the model weighs 14 pounds, this works out to 14 x 65 = 910 watts. Assuming that any good-quality motor, either brushed or brushless, will work well at a current draw of at least 25 amps, this is a safe minimum on which to base a choice. If the motor you choose will safely handle more current, which the manufacturer's data sheet will tell you, you'll have the option of loading it more heavily for higher performance. Because power (watts) is the product of volts x amps, divide 910 by 25 to get 36.4. This is the voltage you need. Because both Ni-Cd and NiMH cells work at 1.2 volts per cell, divide again (36.4 ÷ 1.2 = 30.3) to determine that you need a motor that will operate on 30 cells to fly the model the way you want. The Astro Cobalt 60 using either a gearbox or a belt drive will do the job, as will several Aveox motors.

PERFORMANCE FORMULAS

The following simple formulas will help you to fine-tune your choice of equipment and ensure that your model will fly safely. Applied within the size and performance range of our models, these formulas produce results that are accurate enough to allow reasonable choices in choosing electric power equipment. As a general rule with airplanes of the sort we are talking about, the best props are the biggest ones. Scale prop diameter is the goal and, in most cases, gear and belt reduction drives will allow you to meet it. Given a choice of belt or gear ratios that will make the motor draw enough current to meet your input power requirement, the one that works with the prop closest to scale diameter will usually be the best. Here are three equations that will help you to fine-tune prop selection.

An all-out fighter project on electric power, this 1/5-scale A6M5 was built from a Dave Platt* kit and has pneumatic retracts, full working flaps, tank drop and sliding canopy. Power is supplied by a geared Astro 90 on 36 cells. It flies well enough to cruise gear-up at ½ power, but it does not have enough reserve performance or duration to make it a practical contest airplane.

• **Prop speed.** Rpm x pitch in inches ÷ 1,056 = speed. This formula is based on the action of the prop as an "airscrew" and includes all of the conversion of units necessary to read out as airspeed in miles per hour. It is, of course, an approximation and glosses over many factors, but when checked in time traps or by radar, it is usually accurate to within 5 to 10 percent.

• **Scale speed.** Scale model speed = full scale speed ÷ $\sqrt{\text{scale factor}}$ (scale factor is the denominator of the fraction that denotes scale, e.g., 4 for a ¼-scale model). This has been defined by scale modelers in many different ways. This formula makes the most sense to me and produces speeds that can reasonably be flown by most models. This formula gives you a tangible goal to work toward when using the prop-speed formula to help select the best propeller pitch.

• **Stall speed.** 3.7 x $\sqrt{\text{wing loading}}$. This formula can serve as a useful safety check and tells you what margin of safety has been built into the performance envelope of your scale model. A full-throttle flight speed of at least twice stall speed is desirable; 2½ to 3 times stall is better.

E-powered RC scale airplanes have been proven to be practical for both contest and weekend sport flying, and the advantages offered by electric power make it well worth learning about. Careful application of the principles outlined here will ensure your success with your first electric scale project, and you'll wonder why you waited so long to try it!

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✈

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

A small, light, dual-conversion receiver

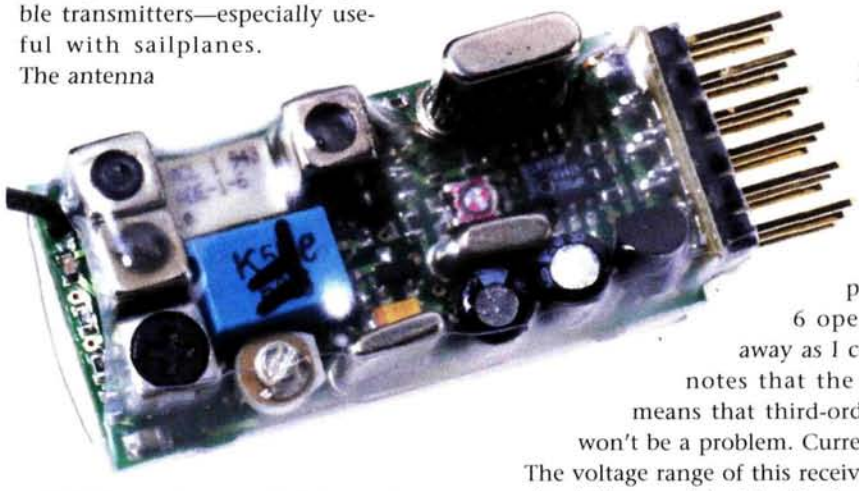
FMA DIRECT

Quantum 6

by Bob Aberle

The founder of FMA Direct*, Fred Marks, has been in the RC business for as long as I can remember. His RC equipment design goes back to the '60s, and he started FMA Direct to offer universal RC aftermarket receivers to benefit modelers who use all radio types. Having extra receivers is especially important for pilots who use today's multi-memory transmitters.

The new Quantum 6 is the latest full-range, dual-conversion receiver to join the FMA Direct line. It weighs just ½ ounce (including the antenna) and is capable of flying indoor micro models up to ¼-scale giants. Intended as a replacement for FMA's Tetra and Micro-2000 receivers, the Quantum 6 has six channel functions and is 2¼ inches long (including the connector pins), 13/16 inch wide and ¾-inch thick. Interestingly, this 6-channel receiver reads channels 1 to 4, then 6 and 7; this accommodates the special mixing functions of some programmable transmitters—especially useful with sailplanes. The antenna is 39.75 inches long, which is exactly a quarter wave at 72.5MHz (the approximate midpoint between channels 11 and 60). Of course, the Quantum 6 meets the 1991 AMA/FCC guidelines (as does the rest of the FMA line).



The Quantum 6 is available on all 72, 50, 53 and 75MHz channels and is designed to be used with FMA's standard Fortress crystals and new, low-profile Quantum crystals.

The Quantum 6 has gold-plated, universal connector pins that will accept Futaba, Hitec, JR and Airtronics-Z servo and battery connectors. The Quantum 6's center pin (of the three) is battery positive. As with most FMA receivers, its connectors are on the end of the case; this makes installation much easier—especially in models that have narrow fuselages. You need to buy the Quantum 6 in a Futaba/Hitec or JR/Airtronics-Z configuration to work with your FM RC transmitter; it won't work with both types.

As with other FMA products, the Quantum 6 comes with excellent user instructions.

SPECIFICATIONS

Model: Quantum 6

Manufacturer: FMA Direct

Type: dual-conversion, FM RC receiver

No. of channels: 6 (1 to 4, plus 6 and 7)

Weight: 0.5 oz. (including antenna and heat-shrink case)

Dimensions: 2¼x13/16x¾ in.

Antenna length: 39.75 in.

Connectors: universal; will accept Futaba, Hitec, JR and Airtronics-Z

Street price: $69.95 (receiver), $12.95 (crystal)

Comments: the Quantum 6 is an aftermarket, FM, dual-conversion receiver that can be operated from most brands of RC transmitters. It is full-range, lightweight and small and will fit most RC applications.

PERFORMANCE

I ran my usual set of receiver tests; these include bombarding the test receiver with adjacent channel signals just 20KHz away. As expected, no interference was noted. Range wasn't a problem, either; the Quantum 6 operated perfectly from as far away as I could see the test model. FMA notes that the 3OIP spec is +12dBm; this means that third-order intermodulation products won't be a problem. Current drain at 4.8 volts is 21mA.

The voltage range of this receiver is 3.5 to 26 volts, although you should be careful with this figure because the receiver's battery supply is shared with that of the servos. Above 6 volts or so, your servos will be going much too fast. To be on the safe side, stick to 4- or 5-cell battery packs unless you are operating the receiver using the BEC of an electric motor speed controller.

The Quantum 6 dual-conversion receiver exhibits excellent range and selectivity, is extremely small and lightweight and can fly any size model from micro to ¼ scale and larger. If you need an extra aftermarket receiver that will fit a lot of applications, the Quantum 6 is the way to go.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✚

MODEL AIRPLANE NEWS
PRODUCT
REVIEW

Low-cost reliability

JR REMOTE CONTROL

J-Line Quattro

by Bob Aberle

Ease of operation, basic controls and a low price tag make the new J-Line Quattro radio from JR Remote Control* very attractive to newcomers and advanced modelers who want a basic extra transmitter. With four control functions (aileron, elevator, rudder and throttle), this FM radio is very simple to operate, and an easy-to-read, extremely thorough instruction manual will help new modelers understand the system. The Quattro also has four servo-reversing switches, one for each channel, and a trainer cable input and switch.

The system comes with a transmitter, a JR R600 6-channel receiver, four JR NES-507 standard servos, a dual-output battery charger, Ni-Cd battery packs for both the transmitter and receiver, a switch harness, an aileron extension cable, extra servo output arms and mounting hardware, a frequency flag and an instruction manual. The system is available on all 72 to 73MHz RC aircraft channels except channels 11 to 14.

TRANSMITTER

The Quattro transmitter is of the conventional dual-stick variety, with aileron and elevator control on the right stick and rudder and throttle control on the left. If you fly a 3-channel model that has only rudder, elevator and throttle, then both rudder and elevator would be handled by the right stick. Each of the four channel functions has a trim lever that allows you to precisely set your model for level flight attitude.

A rechargeable, 600mAh 8-cell Ni-Cd battery pack can be accessed using a compartment door on the lower rear of the transmitter case. The servo-reversing switches are underneath the battery. After you've set the switches for a particular model, there's no need to access them until you fly another model.

The main power switch and three colored LEDs that indicate battery condition are on the front of the transmitter. If all three LEDs are glowing (green, orange and red), it is OK to fly. If the green LED goes out, it's time to recharge, and when

The new J-Line Quattro 4-channel basic FM RC system comes with four NES-507 servos, R600 FM receiver, 4N600 Ni-Cd airborne battery pack and an excellent manual.

just the red LED is glowing, don't fly. This LED system is simple and effective.

You can adjust the length of both control sticks but not the spring tension. Under the handle, there's an attachment point for a neck strap (an optional accessory).

The JR R600 FM receiver is sometimes called the "credit card" receiver because of its rather thin case. Although six channel functions are available, only four are used in this application.

TRAINER FUNCTION

A nice, extra feature on the Quattro is its trainer capability. At the top left corner of the transmitter case, there's a spring-loaded switch labeled "trainer." To take advantage of the trainer capability, you need only a JRPA130 trainer cable (available separately) and another JR transmitter (preferably another Quattro).

To operate this trainer function, simply connect the trainer cable between the two

Three colored LEDs indicate the status of the Ni-Cd battery pack charge level. When the green LED goes out, it is time to recharge the battery.

With the battery pack removed, you can access the four servo-reversing switches. The fifth and sixth switch positions are not used on this transmitter.

transmitters. Make sure that the servo-reversing positions on both transmitters are identical. When the student flies, the instructor holds the trainer switch; if the student needs assistance, the instructor simply lets go of the switch and takes over flying. A very basic transmitter like the Quattro is perfect for this trainer application.

AIRBORNE GEAR

The JR R600 FM 6-channel receiver is small and weighs just 1 ounce. The JR NES-507 standard servos weigh 1.5 ounces each and have an output torque of 40.3 oz.-in. A 600mAh Ni-Cd 4-cell battery pack provides the airborne power and weighs 3.2 ounces. The all-up weight of this airborne pack, with the switch harness and an aileron extension cable, is 11 ounces.

If you want to fly small parking-lot or indoor RC models, you can use JR's new 0.5-ounce R-610M micro receiver and 0.32-ounce, NER-241 sub-microservos. Like all JR RC equipment, these components are fully compatible with the Quattro transmitter and can be combined with lightweight, low-capacity battery packs to produce an airborne system that weighs only an ounce or two.

The right dual-axis control-stick assembly. Stick length can be adjusted, but spring tension cannot.

SPECIFICATIONS

Model: J-Line Quattro

Manufacturer: JR Remote Control

Type: basic 4-channel, FM radio available on 72 to 73Mhz aircraft channels. Modulation is FM (PPM) with high-side deviation.

Transmitter: 26.7 oz., 4-channel dual stick (Mode-II) with conventional trim levers. The RF module is built into the case and is not removable. Charging jack's center pin is negative. Three colored LEDs indicate battery charge status.

Receiver: JR R600 (1 oz.); uses ABC&W circuitry; has six available channel functions. JR connectors plug into the end of the case.

Servos: four JR NES-507 standard size (1.5 oz. each), output 40.3 oz.-in., 0.25-second transit time for 60-degree rotation. Servo cables are 11 inches long.

Accessories: switch harness with charging jack, 4-cell 600mAh airborne Ni-Cd battery pack, dual-output battery charger, aileron extension cable, servo-mounting hardware and extra output arms, frequency flag set and instruction manual.

Weight of airborne pack: 11 oz. (receiver, four servos, switch harness, battery and aileron extension cable).

Street price: $149.95

Hits

- Easy to learn to operate—especially good as a first radio system.
- Excellent and thorough instruction manual.
- Trainer cable provisions.
- Servo reversing switches for all channels.

Misses

- Servo reversing switches are a little hard to reach.

SUMMARY

The J-Line Quattro is a good first radio system that's easy to operate, and it comes with an excellent, very thorough instruction manual—especially important for a basic radio that's intended for beginners or sport fliers. The Quattro's servo-reversing switches and built-in trainer capability are a real touch of class and, of course, the bottom line is that the J-Line Quattro is very affordable. If you're looking for an inexpensive, easy-to-use RC system, this one is just the ticket.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✚

A nostalgic link to modeling's past

by Hal deBolt

RC-ASSIST AIRFOILER REPLICA

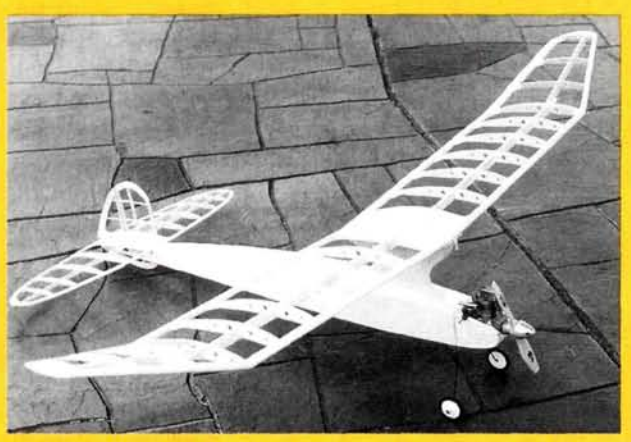
The Airfoiler is a replica of a model Hal deBolt designed and flew in free-flight competition in 1940. Legal for SAM RC-assist flying, the Airfoiler has much antique appeal.

The first Airfoiler was created in 1940, and the updated design presented here is legal for Society of Antique Modelers (SAM) competition. The second one was born in wartime. It was quite different in design and was kitted by Dmeco in 1947. In the prewar years, I was deeply into free flight. I had outgrown my '37-'38 Blitzkrieg when Carl Goldberg impressed me with his Valkyrie. I had lost several Blitzs for lack of a proper dethermalizer. At the time, spoilers were the only known lift reducers. So with Carl's influence and a need for a new design, I designed the Thunderbolt. The spoilers did the trick; the T-Bolts kept on ticking. Winning contests without losing models gave me more time to look for things to improve.

Believing that a wider wing chord would perform better, I used a 5:1 aspect ratio with the T-Bolts. I did, however, have a desire to compare a higher ratio wing with the one I was using. Obviously, investigations do not require an exotic model; a simple box-style is sufficient. Bellanca's lifting-body ideas were also impressive. Regarding Bellanca: if the box had an airfoil shape, it could be added to the mix while adding some cosmetic appeal to my model.

Foresters were said to be fine engines then, and I wanted to try them. They came as a .29 and .305, so with a simple engine exchange, a single model could fly in two competition classes. So the Foresters dictated my model's size. Right off the board, the new model proved to be a very kind flyer—extremely easy to use and surprisingly competitive. However, the War terminated my free-flight activity, and I was unable to determine which of the new designs was superior.

Sometime in 1943, on a weekend home from the Navy, I learned that a local contest had been scheduled. I hadn't competed since my induction, so I had to fly my 'Foiler in this one. The model's performance at the meet was like something I'd never seen before! The weather was free-flight perfect, and the first two flights ended (dethermalized) on the field with excellent time. For the next flight, I locked the spoilers into place, and the 'Foiler sat sky-high, right over the field; it didn't want to come down. Eventually, it lost lift and landed less than ¼ mile away. The flight time was hard to believe; one hour and five minutes! Fantastic? I was in free-flight utopia!



The design is simple, light and strong. The original had a single retractable landing-gear leg, but the new design has been flown well with the standard gear shown here.

Recently, Fred Mulholland and Tom McCoy enticed me to seek SAM approval of my three designs: the Blitzkrieg, Thunderbolt and Airfoiler. All three were approved. As good friends will do, Fred and Tom agreed to produce the needed replicas of my models, so I give considerable credit to them for making this article possible. Fred built a 'Foiler replica and reported fine contest performance. Tom also built one that he now flies regularly.

SPECIFICATIONS

Model: Airfoiler replica

Type: Antique, SAM RC assist, or free flight

Wingspan: 60 in.

Wing area: 505 sq. in.

Length: 35 in.

Weight: 36 oz.

Wing loading: 10.25 oz./sq. ft.

Airfoil: under-cambered

Power required: .29 to .30 2-stroke

Powered used: O.S. .20 4-stroke

Prop: 10x6

Radio req'd: 2- or 3-channel (aileron, elevator and throttle optional)

Comments: the Airfoiler is a replica of Pappy deBolt's original model from 1940. Simple, yet light and strong, the model has polydihedral, and the plan shows controllable elevator and rudder-control surfaces. These can be omitted for free-flight.

CONSTRUCTION

The original Airfoiler was pure free-flight. Today, we have "RC-assist," for which the needed control surfaces are shown. If you like vintage models, the Airfoiler structure is very common to the era. To build the free-flight version, simply omit the control surfaces.

The tail is the easiest place to start. The stabilizer and fin have curved profiles, so begin by producing the indicated outlines. These surfaces use "quick and dirty" cap-strip-style ribs bent around a spar. The secret with these is first to soak them in water and to form the curves with your fingers before installation.

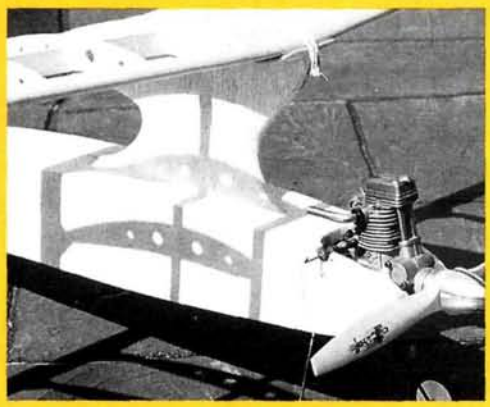
WING

Start by cutting out the ribs as shown on the plan. Note that the wing has rather robust leading and trailing edges. These are needed for strength and to prevent the wing from warping when the silk covering is shrunk tightly. All balsa is medium weight except for the spar, which is 8 to 10 pounds per cubic foot, straight grained. Today's obsession with excessive power might dictate 10- to 12-pound balsa or an equivalent. Tom and Fred capped the spars of their replicas with carbon fiber.

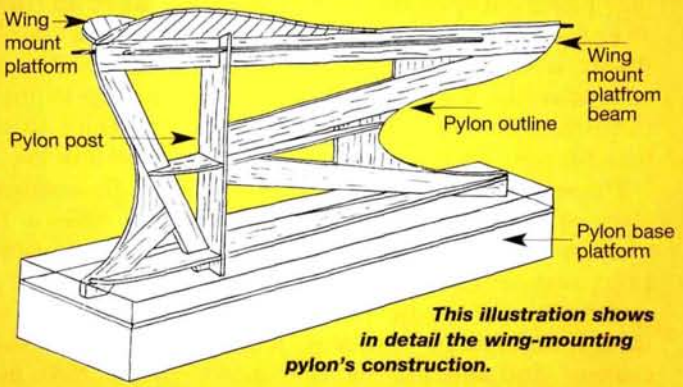
The spoilers are hinged at their front edges and are opened by a no. 16 rubber band to a maximum of ¼ inch above the wing surface. I use an Austin timer with a suitable linkage to activate the spoilers after a desired time.

FUSELAGE

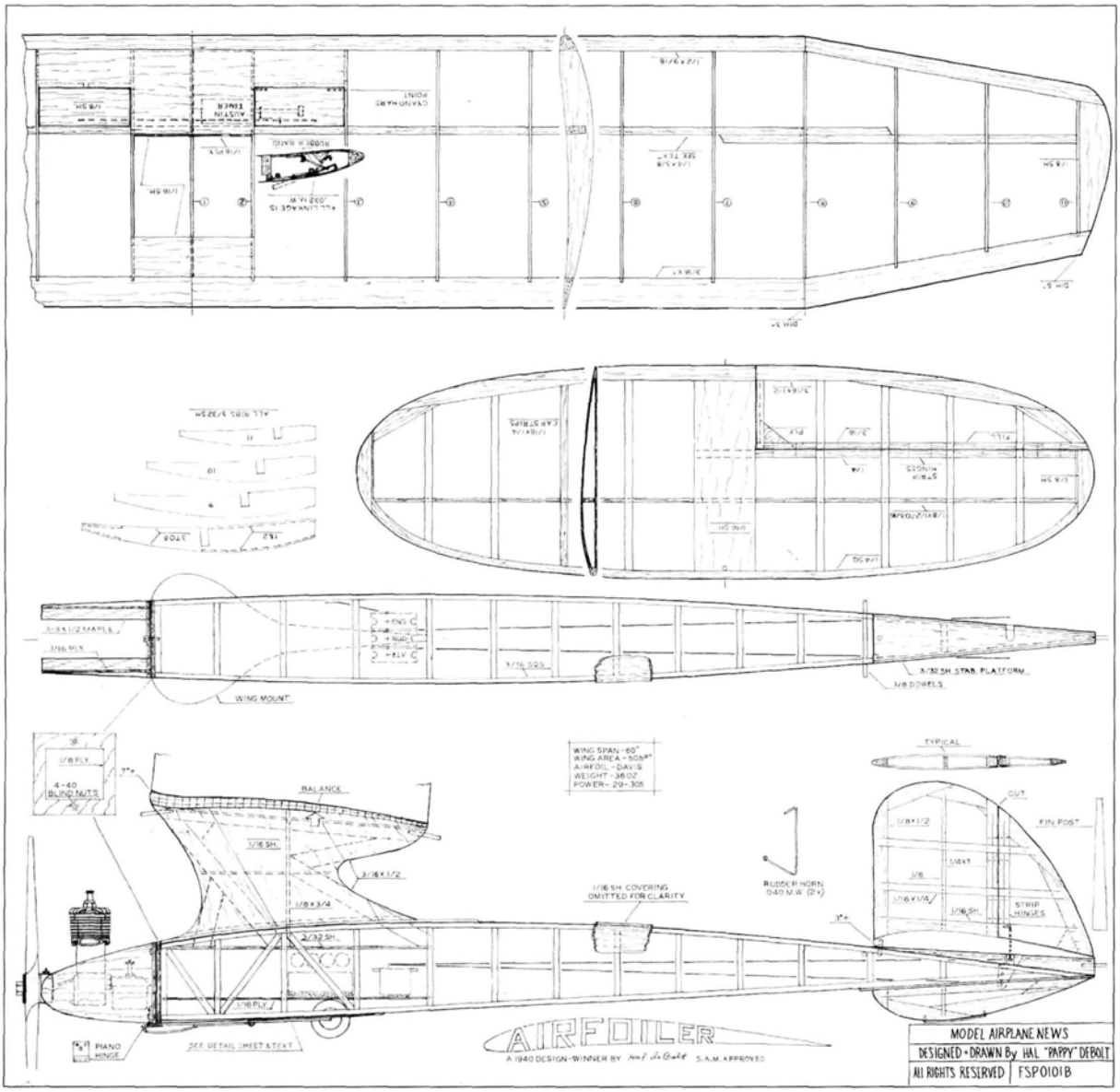
The basic structure uses balsa stick construction and is very easy. This is covered with lightweight 1/16-inch sheeting. Build the sides together (one on top of the other) and then sand their edges so they are identical. Place them vertical on the assembly board using a centerline as a guide while you join them with balsa crosspieces, as indicated. The wing pylon is built separately and then attached to the fuselage floor. The pylon post and ribs



An O.S. .20 4-stroke engine is a fine choice to power the Airfoiler. Note the lightening holes in the wing ribs.



This illustration shows in detail the wing-mounting pylon's construction.



To order the full-size plan, turn to "RC Store" on page 200.

are then installed, followed by the sheet covering.

The construction of the pylon wing saddle is a neat trick. First, protect the bottom center of the wing with clear food wrap. The two halves of the wing-mounting platform are cut oversize and placed between the wing and the pylon. After the wing has been properly aligned with the fuselage, the platform is glued into place and then trimmed to shape after the wing has been removed (see illustration). The advantage of this method is that the wing sits in a saddle that is an exact copy of the wing's shape; thus, the wing has little tendency to shift.

The original engine mount was held in place with rubber bands and dowels. I made the new engine mount removable, along with an equipment tray, thereby making it simple to perform engine-thrust adjustments and/or engine changes. Also note that the plan shows the original retractable landing gear. A simple wire gear can be easily added, as shown in the photos. Note that the retract gear leg is formed with music wire and uses a "stop" so that as the model rests and taxis on the ground, the wheel is forward of the hinge point. When the model lifts off, the rubber band swings the gear back, eliminating much air drag.

BEFORE COVERING

Scribe a reference line down the length of the fuselage in line with the engine's thrust line. From this line, measure to the leading and trailing edges of both the wing and stabilizer, and check that the angles of incidence for both are as shown on the plans. These settings do not have to be exact, but they should be close. Next, make sure that the stabilizer aligns properly with the wing. If it doesn't, adjust the stab's saddle until the wing and stab are parallel to each other. Also make sure that the fin is straight and vertical.

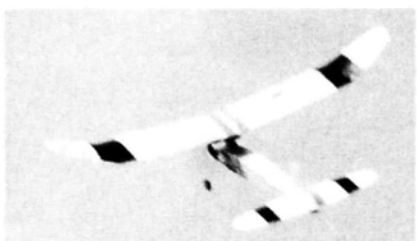
Balance the model with "risers" placed under the fuselage and a 3/8-inch-square stick on top of them; move the fuselage fore or aft until it "teeters." The riser sticks should be placed beneath the indicated balance point. Move the RC equipment around on the tray until the model balances level. Last, take a good look; everything should fit properly and just look right.

COVERING

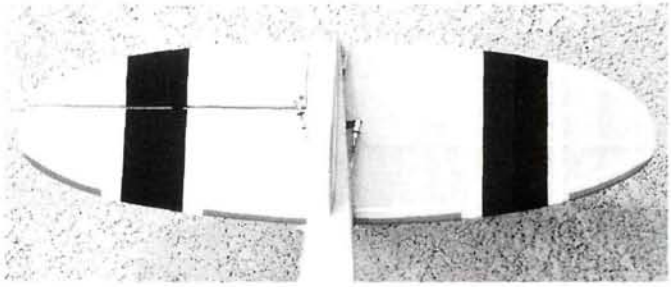
The 1940 'Foiler was covered with silk and dope, and this is still a great method to use today. Using your favorite film covering is also OK. The original model's wing and tail had orange silk and a black fuselage with orange trim.

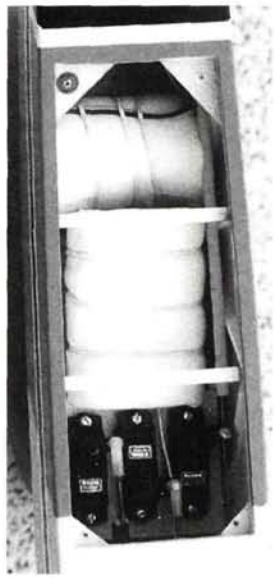
FLYING

If you want RC-assist, today's "mini systems" require about as much space as the original ignition system did, so there is ample room for any type of radio gear. Tom McCoy used an O.S. .20 4-stroke engine to power his replica, and it performs nicely with a 10x6 Pro-Series Power prop.



For a start, you can hang-glide the model to check its trim. A gentle, level push should see a glide of 50 feet or so. If adjustment appears necessary, shim the forward edge to the stabilizer 1/16 inch at





For RC-assist flying, the new Airfoiler has movable elevator and rudder-control surfaces that are used to trim the model for maximum climb and glide performance.

A belly hatch makes it a snap to get to the RC gear. Screws in the corners hold the hatch in place.

a time until you get a smooth, shallow glide. Do the same thing under the wing's trailing edge if the glide appears too steep.

RC-ASSIST

Flight adjustments for SAM-style flight are to obtain a straight climb and a flat glide. Be concerned with power first; launch the model at low power so the climb is shallow but straight. If it has a tendency to turn, use a thin shim under the engine-mounting joint. Adding a bit more power each time, repeat the process during several flights. At about ¾ power, note the angle of climb; it may be too steep. With full power, the model might go past vertical. If it does, add more positive stabilizer incidence. Initially, be careful at full power so that the model does not go past vertical and end up on its back—not good! If the glide appears too steep in the power-adjustment phase, simply move the balance point backward until the glide is flat. Balance changes do not affect powered flight performance.

The Airfoiler was very competitive at the early free-flight meets. It will still perform well today, especially if there are some thermals around to exploit. To quote Tom McCoy: "Hey, guys; I can hardly see the darn thing. It just does not want to come down; sure loves thermals!" Is there anything more to be said? Have fun!

Hal "Pappy" deBolt—a lifetime of modeling

We have been privileged to have many distinguished modelers contribute to the pages of *Model Airplane News*. Many readers have grown up reading articles by Grant, Zaic, Thomas, etc. One modeler who cut his teeth on such articles is our own Hal "Pappy" deBolt, who has gone on to inspire an entire generation of modelers with his own model designs and contributions.

Pappy got his start in the 1920s when he built his first model out of scrap spruce and glue from his Uncle Clarence's homebuilt-aircraft shop. Throughout his early years, Hal built, flew, crashed, redesigned—and flew again—free-flight models, always trying to improve his building and "trimming" skills. While in Geneva, NY, he won a local contest, and his prize was a trip to the 1933 Nationals. This was the opportunity for Hal to see the likes of Bassett and Kovel compete. Hal says the direction of his life was set after this experience.

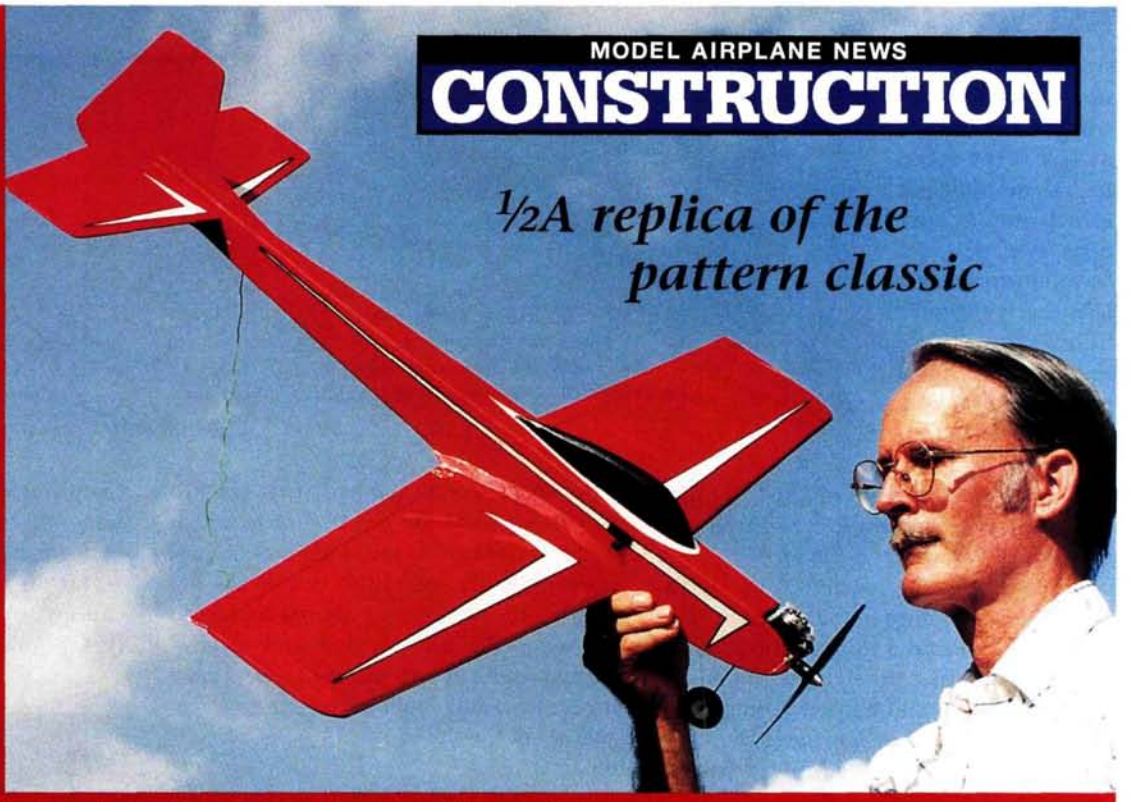
Hal "Pappy" deBolt (right) and Tom McCoy smile for the camera and show off Tom's replica of the Airfoiler.

Hal is perhaps most famous for his model airplane company of the 1950s and '60s, DeBolt Model Engineering Co. (Dmeco). He has produced free-flight, control-line and RC models; the list is impressively long. One example of Hal's designs is a control-line model called the "Bipe," some 50,000 kits of which have been sold.

It's wonderful to have Pappy with us today as a contributor to our first issue of 2001. His Airfoiler replica is a nostalgic link to our modeling past and a testimony to his modeling longevity. Thanks, Pappy—for everything.

—Gerry Yarrish

½A replica of the pattern classic



THE MINI Kaos

by Dave Robelen

How many of you remember the pattern competition models of the 1970s? It was a period of rapid change, and the models were fairly simple. Designed and flown competitively by Joe Bridi, the Kaos became an icon that represented pattern flying of the time. By today's standards, with a mild engine, the Kaos makes a fine advanced trainer or sport model even though, in the right hands, it can fly pattern aerobatics.

Because I am a dyed-in-the-wool small-model enthusiast, I chose the Kaos design scaled down to ½A size as a mini project. With today's powerful new small engines from Norvel* and Thunder Tiger*, many suitable power options are available. It also doesn't hurt that the available RC gear is now smaller and lighter.

I did make one significant change, and that was to the wing airfoil. From experience, I have learned that on small wings, thick, symmetrical airfoils are not the best performers. I substituted an airfoil that had served me well in previous projects. Because I had a Norvel BigMig .061 engine, I used it, though the Thunder Tiger .074 would be a fine alternative.

Nobody can accuse me of playing favorites! My RC installation is a real mixed bag. The receiver is a Berg* 6-channel, the 110mAh battery came from FMA*, two micro servos are from JR* while the others are a micro Cannon* and a Hitec* HS-50. Just to round things out, my

SPECIFICATIONS

Model: Mini Kaos

Type: ½A pattern model

Wingspan: 35.5 in.

Wing area: 230 sq. in.

Length: 33 in.

Weight: 14.5 oz.

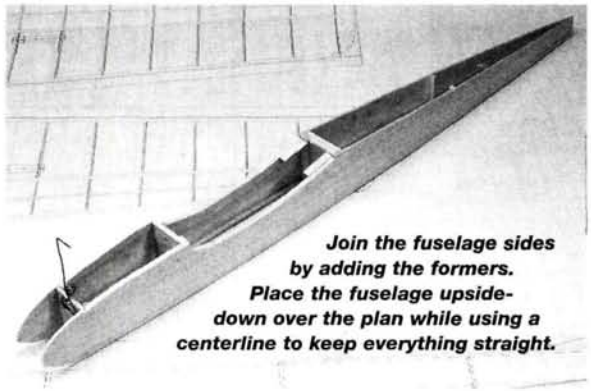
Wing loading: 9 oz./sq. ft.

Power: .061 to .074 glow engine

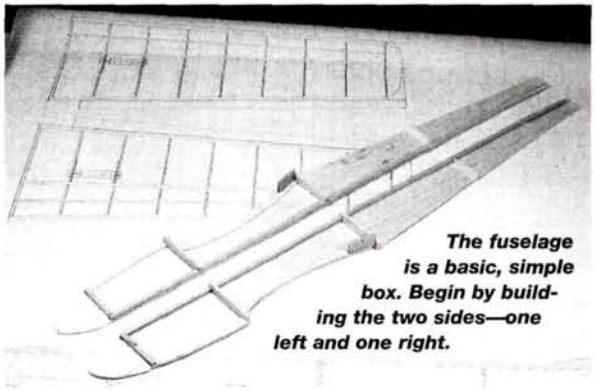
Controls: 4-channel

Comments: this miniature replica of a 1970 pattern model was designed for ½A engines and is fully aerobatic yet docile; an excellent project for anyone with advanced trainer experience.

switch harness is a small Futaba* unit. On the original, I used a Hitec Prism 7X TX and Williams Bros.* smooth contour wheels, but Dave Brown* Electra Lite wheels are much lighter. Finding a small fuel tank is a challenge: I chose a 1-ounce plastic contact-lens-cleaner bottle. The plumbing is made of K&S* 1/16-inch-outside-diameter metal tubes and thin silicone fuel line from Sig* or Du-Bro*.



Join the fuselage sides by adding the formers. Place the fuselage upside-down over the plan while using a centerline to keep everything straight.



The fuselage is a basic, simple box. Begin by building the two sides—one left and one right.

I covered the Mini Kaos with MonoKote*, bonding it completely to the wood. This ensures a tougher model with fewer wrinkles, and it helps the thin tail to resist warping. Wanting to keep things simple, I opted for a fixed nose gear; the huge rudder provides ample control for takeoff steering and landing control. If you prefer, with little extra effort, you could make the nose gear steerable.

CONSTRUCTION

Let's assume that you have a few kits under your belt and maybe even a plan-built model or two. I don't want to cop out on this phase but rather to pass on only the information that may be unique to one of my 1/2A designs.

My prototype weighed 14 ounces all up; to achieve this weight, you must choose your materials and RC gear carefully. Make up a shopping list; note that you will need fairly light balsa throughout (except for the wing spars). By that, I mean wood that has a density of 6 to 8 pounds per cubic foot—a sheet of 3/32x3x36 inches weighing no more than 18 grams (3/4 ounce), for example.

You can make it through this project with a single bottle of medium CA; please leave the heavy epoxy on the shelf!

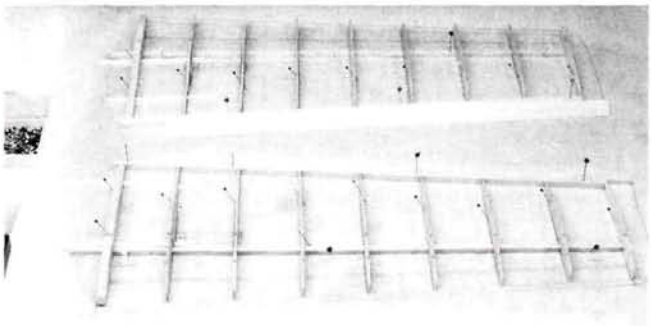
Before you start assembling, make a "kit" of parts to ensure that you have the crucial materials on hand; you'll also be able to check the parts fit before you make things permanent. Make patterns—copies of all the parts that need to be cut out—and use a glue stick to attach them temporarily to the wood (but do peel them off fairly soon after you've cut the parts). This method may also be applied to the wing ribs: use the glue stick to temporarily laminate two pieces of sheet under the pattern, and you'll be able to cut the ribs in half the time.

On the tail, just cut the parts out and sand them smooth; see the bevel on the hinge line? This is important to smooth control. Install the elevator joiner, and set these parts aside.

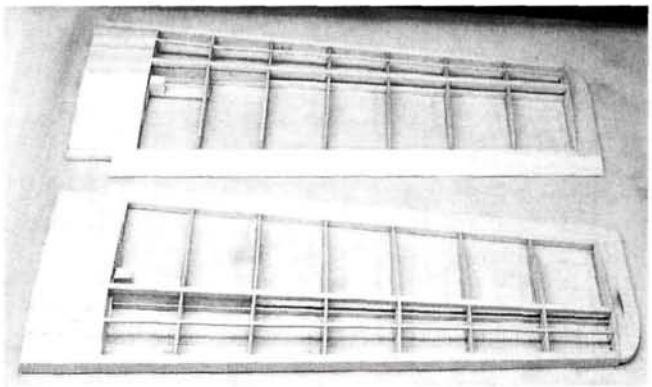
The fuselage is basically two joined side assemblies; refer to the plan to get all the parts in the right places. Work over the top view and install the two center bulkheads and then the firewall (the nose gear should be on the firewall now), and pull the tail panels together. Plank the top and bottom, and you've nearly finished. Finally, take the carving knife and sanding block and trim the corners to a nice rounded shape. The fillets are very much a part of this design, so shame on you if you leave them off!

They not only improve the appearance, but they also enhance flight performance.

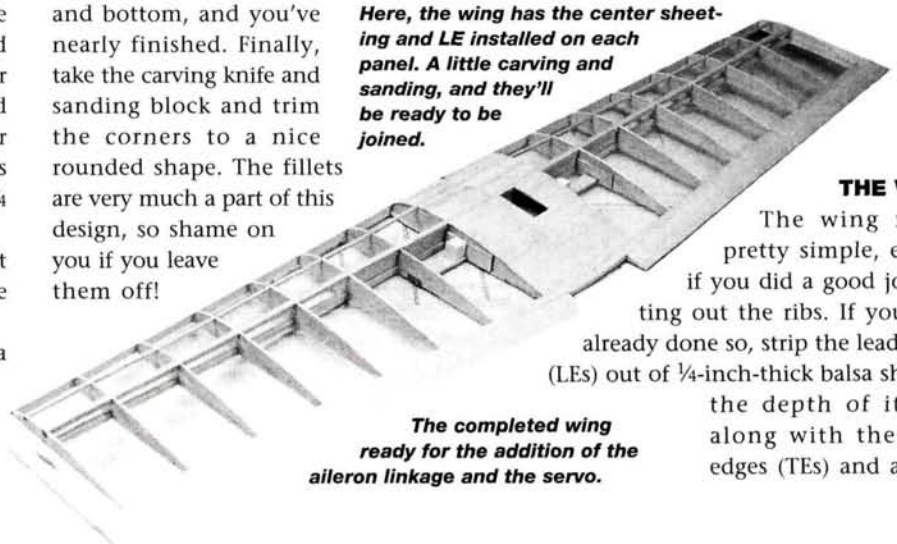
Either hunt down a formed-plastic canopy, or shape a balsa block as I did (yes, I hollowed it out).



Build the wing panels by first pinning down the TEs and the bottom main spars, and then add the ribs as shown.



Here, the wing has the center sheeting and LE installed on each panel. A little carving and sanding, and they'll be ready to be joined.



The completed wing ready for the addition of the aileron linkage and the servo.

THE WING

The wing really is pretty simple, especially if you did a good job of cutting out the ribs. If you haven't already done so, strip the leading edges (LEs) out of 1/4-inch-thick balsa sheet (note the depth of its taper) along with the trailing edges (TEs) and ailerons. I

used little spots of glue to hold the ailerons to the TE strips and then carved and sanded them to shape as a unit. Protect the plan with wax paper while you assemble the wing's halves. I pinned the bottom spar and the TE to the surface, and then I glued in the ribs and the spar webbing. Now glue on the LE and the top spars.

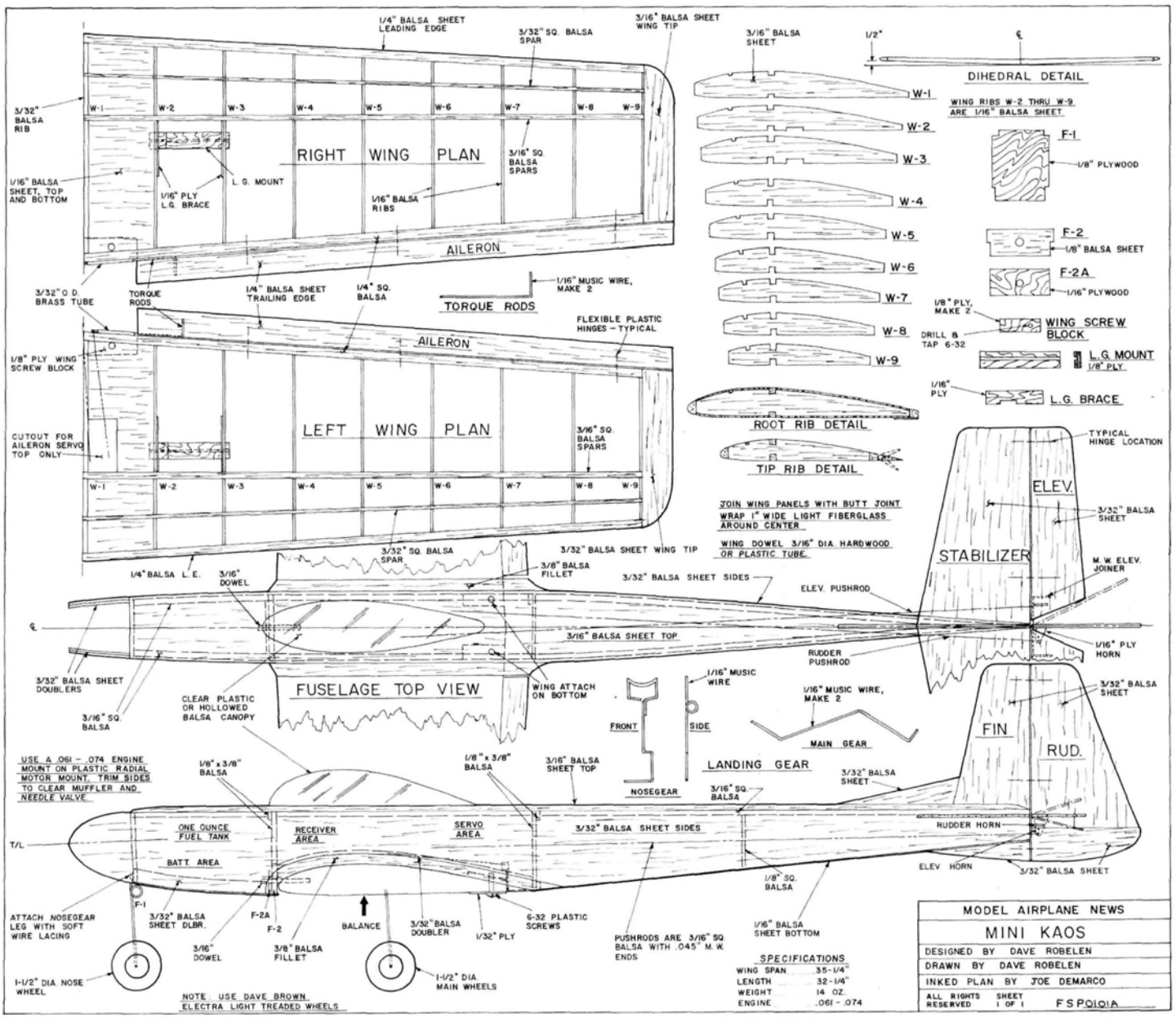
At this point, I lifted my wing panels off the board and added the center sheeting. Take a good look at the wing cross-sections and maybe make templates that will help you carve the LE to the correct taper. Compare the two halves closely to verify that they match. Sand a tiny angle into the ends of the wing roots where they join, and make sure they make full contact. Glue the two halves together as a butt joint, adding slight dihedral, and do what's necessary to avoid twisting the wing. Decide whether you want to add the fiberglass band around the center (I left it off), and then make the aileron-servo cutout.

I use a simple, fixed nose-wheel assembly; you can easily add the hardware if you want one that steers.

This is the point at which I cut the ailerons free and added the linkage to the TE. Remember to sand the bevel on the aileron hinge line! Fit the wing to the fuselage, then drill and tap the hold-down blocks for the hold-down screws and install the dowel in the LE. Remember to leave the planking off the nose bottom so that you'll be able to drill through the hole in the former and in the wing to position the hold-down dowel. I keep writing "dowel," but I actually used a length of plastic tubing from one of those telescopic pushrods. Don't glue this in yet. The covering job goes more easily if you cover first and then glue in the tube/dowel afterward.

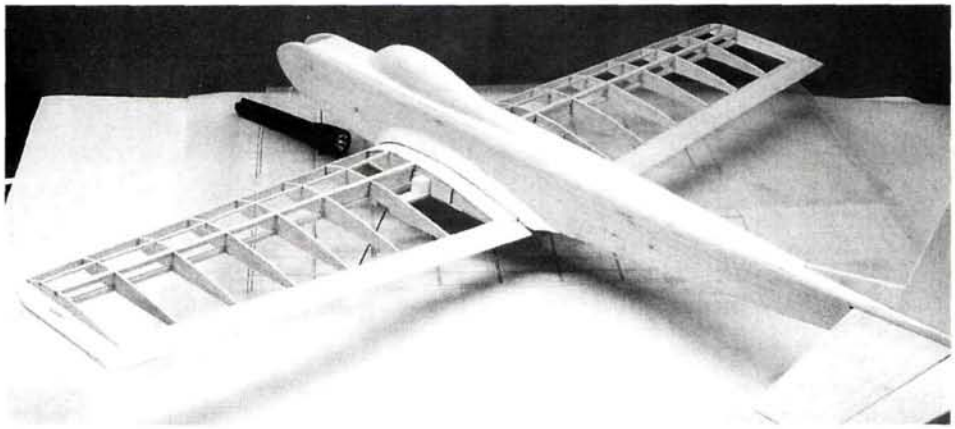
FINAL ASSEMBLY

Cover all the parts with the material of your choice. Go ahead and hinge all of the controls except for the rudder. I use Mylar drafting film cut into ¼-inch-wide strips and fasten it with CA. The torque rods *must* go on the ailerons before they're hinged. The bearings should also be fitted and glued in while you add the hinges.



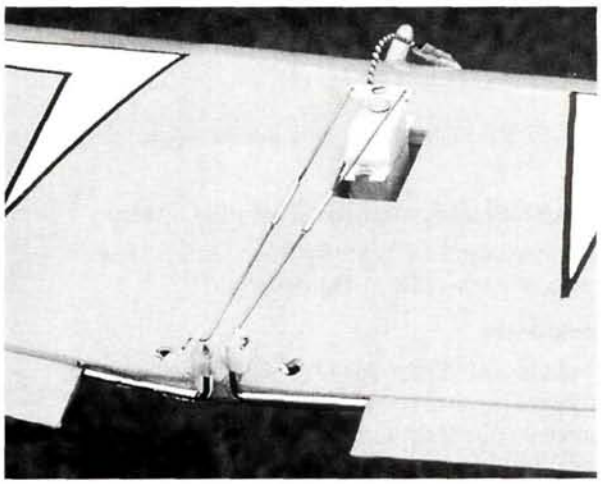
To order the full-size plan, turn to "RC Store" on page 200.

THE MINI KAOS



The Mini Kaos ready to cover.

Mount the wing on the fuselage, and use the wing as a reference point for aligning the tail. If you misalign them, your Mini Kaos will look silly, fly crooked and bring shame to your entire household! Do what's required to get the tail on straight, and then hinge the rudder.

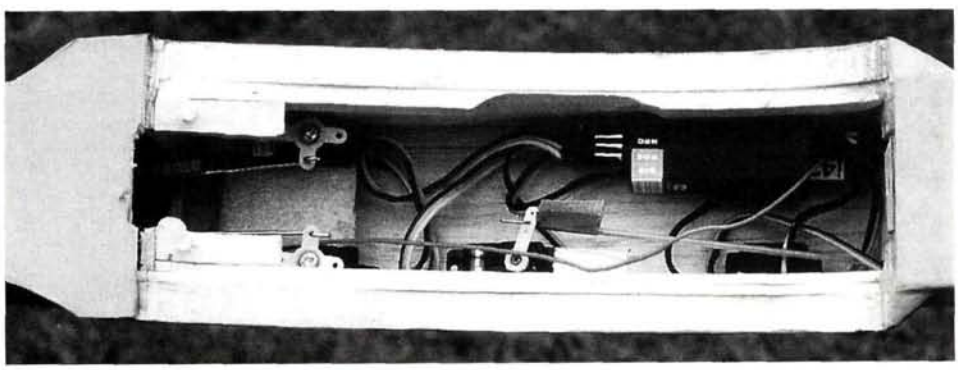


Here, the aileron servo and linkage have been installed—simple and effective.

Cut a couple of control horns out of thin plywood and attach them to the tail surfaces. I made my strip aileron connectors by chopping them out of plastic bellcranks and drilling the necessary holes; they are press-fit onto the rods. If that doesn't suit you, cut some brass tubes, flatten their ends for the pushrod holes and solder them into place. The linkage is a couple of pieces of 1/32-inch wire. Install the engine, aligning the thrust line as shown, and make the cutouts required for the parts that stick out.

I made the clunk for my tank by sticking a length of tube into the end of the pick-up line, and then I wound thin solder around the joint. Fish the tubes through and make the engine connections.

Place the radio equipment in the fuselage and check the balance. Mount the servos where the linkages will fit and in such a way that the model balances. The pushrods in my Mini Kaos are a couple of lengths of 3/16-inch-square balsa with wire attached to their ends. I am fond of using a paper clip for the servo end, but the rear is music wire. Fit the pushrods carefully, and you won't have to bend them. The throttle drive in my bird is a length of 0.020-inch wire between the servo and carb. Do what's needed to get your switch harness mounted, and check all of the controls for

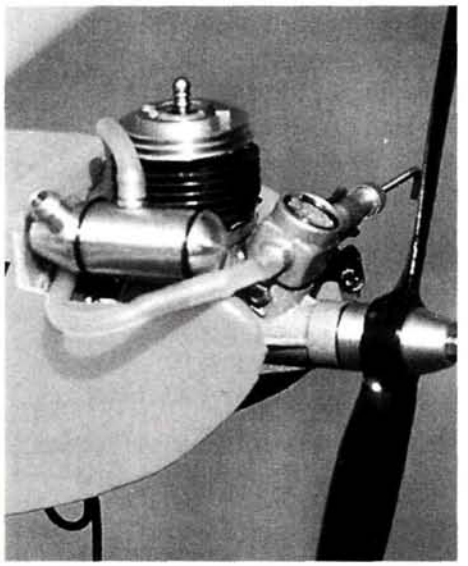


Any of today's mini RC systems will fit the Mini Kaos nicely. The small area trimmed off the fuselage doubler allows the offset wing-mounted aileron servo to fit perfectly.

proper throw and smoothness of movement. Have a buddy drop by and critically admire your latest creation; see whether he notices anything that needs attention.

FLYING

Break in your new engine on a test stand. Follow its manufacturer's instructions, and forget about flying until it will hold a steady peaked setting on the ground. I use the Norvel BigMig .061 with great results,



I used a Norvel BigMig ½A engine for power.

but it does require a proper break-in. (This is especially true of the newer versions that have a ceramic cylinder coating.) It may be the fault of my fuel (K&B* 500), but I have found that the stock glow plug runs much too cold in all my engines. The idle and transition are messy, and the needle valve becomes fussy. Cox* glow heads may be threaded directly into the BigMig cylinder; I use the head from a Cox Black Widow, and my engine runs like a charm!

Do all your range checks with and without the engine running. If you can, plan to launch from the ground; otherwise, just take the engine up to top revs and give the Mini Kaos a forward shove. Let it climb and then check the trims and responses; do a slow pass at altitude to get the feel of things, and then enjoy!

Let me know how you make out, and I will be glad to answer any questions.

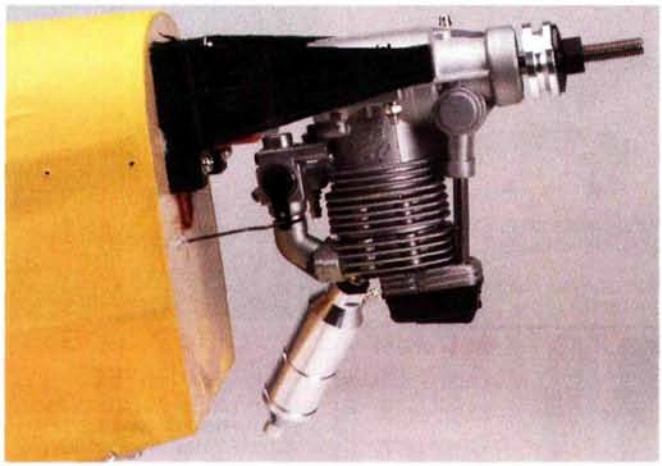
**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* ✈

Honest engine answers

INVERTED OK?

Dear Chris:
Please advise me of the disadvantages or possible complications of installing an O.S. 70 inverted. My O.S. instruction manual doesn't list a contact for technical help.
RUSS

Hey, Russ:
I've run O.S., Saito and Magnum 4-stroke engines inverted with no problems at all. Four-stroke engines don't seem to suffer from inverted operation as 2-stroke engines sometimes do. The 4-stroke's higher combustion-chamber temperatures and more efficient fuel consumption characteristics probably have something to do with this. On some brands of 4-strokes, the glow plug has been moved closer to the exhaust valve—a hot area that helps keep the plug's filament glowing. Such a move also takes the plug farther away from the intake valve and its incoming cool fuel/air mixture. The only thing you must be aware of is not to flood the engine while it's inverted. If a 4-stroke engine becomes seriously flooded to the point of hydra-lock, damage to the engine's internal parts can result if a strong electric starter is applied under such condition. No matter which brand of 4-stroke you are running, make sure it is equipped with an O.S. "F" glow plug. It is simply the best.
—Chris



This OS .52 Surpass has fantastic idle and throttle response characteristics even when mounted in the inverted position. This is true of other brands of 4-strokes as well.

MARKETING BABBLE

Dear Chris:
Something puzzles me. Why do engine manufacturers publish horsepower ratings for their engines? Why don't they specify a thrust at a certain rpm with an appropriate prop, using a stated percentage of nitro fuel?

I ask because when it comes time to talk about props and rotors, our primary concern is thrust. It is thrust that keeps our birds flying. Props and rotors convert torque into thrust, no? Horsepower just doesn't seem to be very meaningful data. Am I missing something?
RANALD HAY

Dear Ranald:
You are missing nothing! Manufacturers use peak horsepower ratings because it is effective marketing to do so; these ratings have very little to do with how an engine is going to fly our models. Those factory-claimed peak hp ratings are often attained at very high rpm levels—levels that aren't usable for 99 percent of the sport, aerobatic and scale models we fly.

Thrust claims are a problem, too, because we're talking static thrust, and static thrust is also misleading. It doesn't tell us much, especially if measured with higher-pitch props that can actually stall when run in the static mode, thus giving a false low-thrust reading. For example: it is theoretically possible to take readings on two props of the same diameter (different pitches) and get a higher thrust reading on the finer pitched one than on the one that's more coarsely pitched. Very coarsely pitched props stall—cavitate, if you will—in the static mode, and this gives a lower thrust reading. Formula One racing props stall badly during takeoff and don't supply optimum thrust on takeoff. Once that plane is moving, however, dynamic thrust is in force, and those racing models really start moving at very high speeds, where the highly pitched props can start to do their thing.

We can take static rpm readings with finely to moderately pitched props of differing diameters, and by slightly over- and under-propping an engine—and, of course, by taking readings on all props of the correct sizes in between—we can get a relative idea of where (at what rpm range) an engine produces the most power. Thrust, however, becomes a truly meaningful assessment only in the dynamic mode when moving through the air. Something that is meaningful and that should be stated for practical purposes is torque—a term you also mentioned. It's the peak torque/horsepower that twists our props for needed thrust. Manufacturers never mention torque in their specs, but I, too, wish they would start doing so.
—Chris

WATCH OUT FOR THOSE "EXPERTS"

Dear Mr. Chianelli:
I read your recent *Model Airplane News* article about engines and oil content in glow fuels. Since I have just bought my first four-banger, an O.S. Surpass .91 FS engine, I am a little concerned about the manufacturer's recommendations: *"At least 18% oil content"* in the fuel to be used. I said I am concerned because we at the field can only get 16 percent oil with 10 to 15 percent nitro Byron fuel, which is very good for our 2-cycle engines, right ?

My friend has a 4-cycle 1.20; he bought castor oil from a lab and added a measured quantity to a brand-new gallon of 16-percent-oil-content fuel to increase the oil/fuel ratio. Is this practice adequate, or should I get the correct fuel?

The "experts" at the field have always recommended using the same 2-cycle 16-percent-oil-content fuel, but they say opening the needle valve so the engine runs cooler is more than enough protection. Is this a valid practice? Should I "break in" the engine first with 18-percent-plus-oil-content

fuel and then switch to a glow fuel with a lower oil content?

GABRIEL ZAMORA
Mexico City, Mexico

Dear Gabriel:
If simply opening up the needle is an acceptable offset to too little oil, what happens if your engine inadvertently goes lean in the air? (And sooner or later, it will.) Obviously, this is not an adequate safeguard. I'm sorry, but I do not think 16 percent oil is enough for a 4-stroke—or a 2-stroke—period! And I'm not alone in this belief.

If the engine manufacturers state "18 percent oil," don't second-guess them; and be careful of self-appointed "experts" who claim to know more than the guys who made the engine. If you have fuel with 16 percent oil, there is nothing wrong with adding another 2 percent (2.56 fluid ounces per gallon) of castor. Lots of guys add extra oil all the time, and none of them have hurt their engines doing so. Just make sure the castor is of degummed, premium-grade quality.
—Chris

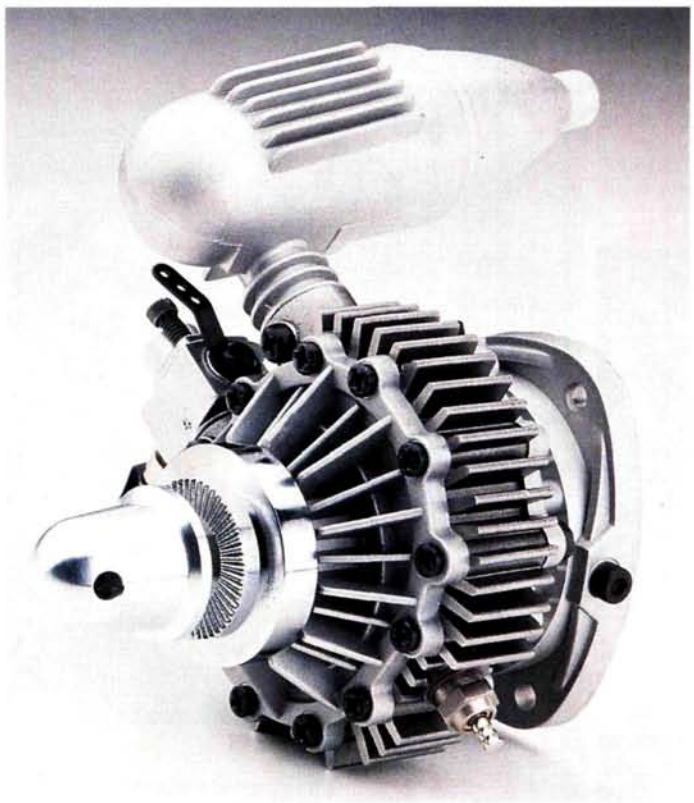
WANKEL WONDERINGS

Dear Chris:
My history with the Wankel engine is very good, as I worked with Fichtel-Sachs on the development of the Hercules Wankel Motorcycle and also rode the Wankel-powered dirt bike at the Isle of Man in the 1975 International Six-Day Trials. But I am still in need of your expertise with this engine. Any information will be helpful, as I have just obtained a Wankel engine, new in box but with no instructions. I would like to get a manual and updates on any changes made to the O.S. Wankel of today.

Here are my questions:
1. What fuel is recommended? We had to use a very high oil-to-gas ratio with the Sachs Wankel to accomplish proper cooling and lubrication.
2. Is it OK to tap into the muffler to pressurize the fuel tank?
3. Are any upgrades available to improve the performance of the exhaust-port timing? I am guessing, but I believe the engine I have is about a 1973 vintage: no. B211.

Your discussion of oil content in the October 2000 "Air Power" column was very good and prompted me to request this information from you.
DAVE (also an engine lover)

Hi, Dave:
Although O.S. improved the situation in later years, the apex wipers on the first Wankel could be damaged in just one overly lean run. I used to add an extra 3 or 4 percent Klotz synthetic oil to my fuel as a "special blend" for the Wankel. Mind you, this was in the days when 20 percent lubricant was normal in model aircraft glow fuel. You might want to try adding at least 3 to 7 percent Klotz to today's fuels. The amount, of course, depends on whether your Wankel is an old- or new-generation design.



It's fine to tap the muffler, but I used to leave off the muffler because this would allow the engine to run cooler. Since the Wankel has 120 degrees of exhaust-port length, leaving off the muffler does not produce the "crack" sound as it does with a conventional piston engine. With the right prop, a Wankel with no muffler can pass certain noise-level restrictions.

I recommend breaking in your Wankel with a 10x6 APC (cool, low-humidity days are best) and running it on a 10x7. The new Wankels are lighter and don't seem to be quite as sensitive to lean runs, but generally, I feel all Wankels need more oil than piston glow engines.

Have fun. —Chris

HOW MUCH TO ADD?

Dear Chris:
I work for an RC company in Ohio. You would not believe the gross things I see when they work with engines. No break-in; dial 'em in and fly. Needless to say, I do not follow the advice of anyone there.

My question concerns castor. I am about to break in a Saito 150. Saito's instructions simply say to use a good-quality 2-cycle oil; too simplistic for my engine. Therefore, I talked this subject around and found that most people recommend that break-in oil be straight castor, at least in the 20 percent range. My problem is that I was given a gallon of racing fuel with only 10 percent synthetic/castor blend. How much castor and/or synthetic do I add to bring this up to 18 percent oil content? Is it even wise to use this fuel? I can buy all the ingredients, but what do I do with a whole gallon of break-in castor?
DSPEN

Dear DSPEN:
For my 4-strokes, I like about 3 to 4 percent of my total oil mix to be castor. You don't want the entire oil content to be castor. The collateral benefit of some castor oil is as an anti-corrosive. If you run all castor, you're going to have to perform varnish clean-off sessions much more frequently. If you have access to fuel with only 10 percent lubricant, for break-in, I would add another 10 percent oil: 6 percent synthetic (7.7 fluid ounces) and 4 percent castor (5 fluid ounces). For running after break-in, I would change to adding 4 percent each of both synthetic and castor. I use Klotz for the synthetic and a premium grade of degummed castor.
—Chris

Send in your event coverage. Mail photos, captions and text (500 words or less) to "Grassroots," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Color slides and prints are acceptable.

Mather Aerospace Lazy Bee Fly-In

Les Gillett on the Slalom course.

Rarely in model aviation has a single modeler changed the face of flying around the world. In recognition of this unique occurrence, the Mather Aerospace Modelers of Sacramento, CA, recently held their third annual Lazy Bee Fly-In to honor Andy Clancy and his whimsical creations.

These guys are self-professed members of the "Lazy Bee religion" who zealously spread the word about how much fun they have with their glow- and electric-powered Bees. Andy himself made the drive up from Arizona to join the festivities, and nearly 40 other pilots came with 55 Clancy-designed or -inspired airplanes, ranging from three diminutive 22½-inch-span Lady Bugs up to a few 6-foot-span Big Lazy Bees. Official events included Single Pylon Racing, Wingless Slalom, Bomb Drop, Roulette and Assigned Team Formation Flying.

Not just any new model, but an entirely new design called the Turbo Bee, this electric-ducted-fan flying wing easily lifted off the runway with a drop-away takeoff dolly bouncing along underneath (Trexlers, of course).

Pilots in Single Pylon Racing took off from a standing start and circled a pole until the allotted time had elapsed. The winner was determined by the total laps. Surprisingly, large, fast models did not have a clear advantage. Smaller and lighter models could turn very tightly and, despite often slower speeds, were frequently among the top finishers.

Competitors in the Wingless Slalom event taxied only their fuselages through a series of pylons and then across the finish

Left: powered by three O.S. .10s, Dave Sullivan's Triple Bad Bee might be the fastest Lazy Bee ever seen. It tore up the sky with a series of loops, rolls and spins.

Four Stagger Bees.

line to break a suspended balloon. Under-inflated Trexler wheels and the lack of nosewheels provided some interesting lines through the pylons.

In Bomb Drop, each flyer took off with a paper cup rubber-banded onto its wing. Inside was a "bomb" that was to be dropped near one of four targets on the runway. The only way to release the bomb was to generate some negative G forces. Pushing full down-elevator worked well, but only if you had plenty of altitude! Points were awarded for distance from the nearest target, with bonus points awarded if that target had previously been chosen by the pilot.

Dave Sullivan hovers his Lazy Bee.

Left: Eut Tileston's 5-ounce Lady Bug; Speed 280 direct drive, 6x270 NiMH.

Roulette began as soon as the pilot took off and crossed the "ready" line. A spinning wheel commanded anything from "land now" to "five consecutive spins." The pilot then completed the task and landed as quickly as possible. Most pilots went for altitude to await their fate and dove at the strip as necessary.

The official events concluded with Team Formation Flying. Practice was impossible, as pilots were assigned partners that day. There was a good mix of skills levels, which proved quite amusing to the crowd.

At the end of the day, pilots enjoyed a free-for-all. As many aircraft as possible took to the skies en masse. It really was a sight, with several people commenting on the sound of the "swarm" of Bees.

The day ended with awards generously donated by Clancy Aviation, Mather Aerospace Modelers, R/C Country Hobbies, MACS Products and Master Airscrew.

CDs Mike and Susan Bigler did a wonderful job of putting this event together, with additional assistance from other Mather Aerospace Modelers; all of them should be congratulated on a most successful event. I will certainly be back next year with a few Bees of my own.

Left: prototype Stagger Bee from Arizona. Right: Wingeron Stagger Bee prototype.

For more information on the Mather Aerospace Modelers, write to club secretary Dean Raymond, 3378 Irish Mist Way, Sacramento, CA 95826; masmrc@yahoo.com, or visit the club's website at www.geocities.com/masmrc. ✈

Dick Lydeck's P Bee Why (left)—a single-float conversion powered by a Magnum .15 engine, and his Stagger Bee (right).

Troubleshooting gas engines

Gasoline engines are usually very easy to operate. Once they have been properly adjusted, the carb settings can normally be left alone for a long time. Sometimes, however, things can go haywire, and frustration replaces the joy of burning gas. This time, I thought I'd share with you some of the more common problems and solutions associated with running gasoline engines.

TROUBLESHOOTING 101

When you're trying to figure out why an engine doesn't work properly, you need to take a look at the three basic elements that make up the "fire triangle": air, fuel and heat.

You don't want this to happen to your gas engine: some of my flying buddies and I had to tear down my engine at the Warbirds over Delaware meet. Being able to trouble shoot your engine can save a day—or a weekend—of flying.

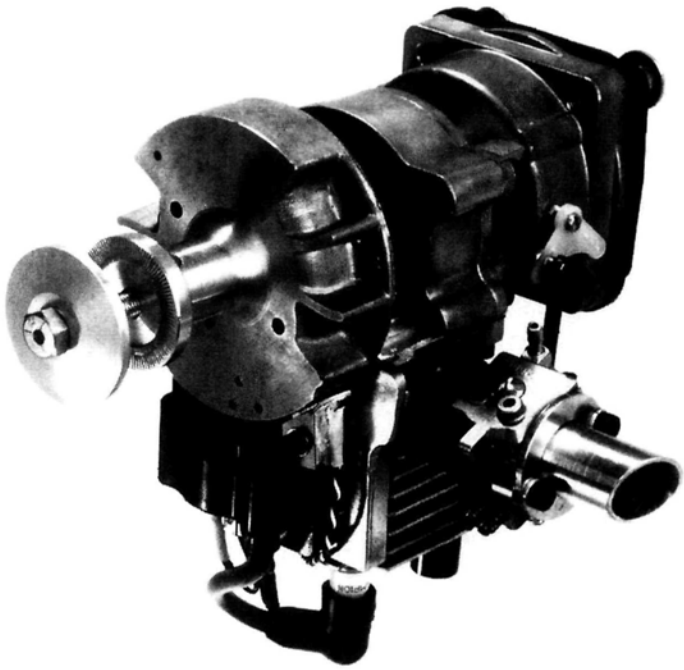
All three are concentrated around the carb and ignition system.

Let's start with the carb. Fuel and air enter it and mix together. If you can't get your engine started, check the following.

• **Needle valves.** These should be about one turn out from fully closed for the high-end needle and about 1⅛ turns out for the low-end needle. Unscrew them completely to make sure nothing is blocking the fuel flow. Then screw them in fully and back them out accordingly.

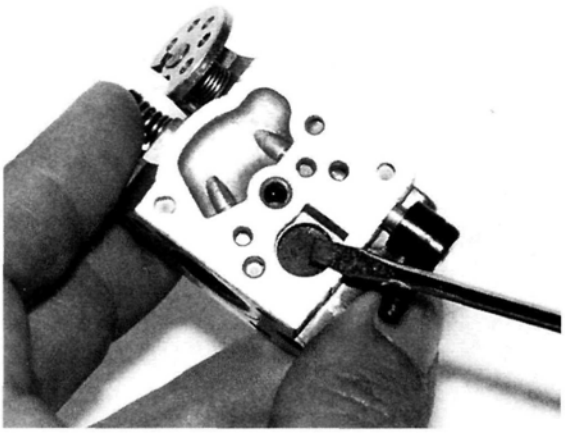
• **Fuel fitting.** Make sure the fuel is flowing into the carb. A blockage here is most often the culprit. Also check to make sure that the fitting is not cracked or leaking. If it is, replace it.

• **Fuel pump.** Place your finger over the carb opening (or close the choke), and flip the prop several times. Is the carb working and drawing fuel? If you have recently taken off the carb, make sure that you have replaced it correctly and that the carb heat/spacer block is in the correct position. A small pressure-feed hole in the block allows crankcase pressure pulses to enter the rear of the diaphragm pump. If the hole in the carb and the hole in the block don't line up, the carb will not work. Also make sure that the holes are not blocked by debris.



When troubleshooting a magneto-equipped engine such as this Cheetah 25 from Reid's Quality Model Products, check the three "fire" elements—air, fuel and heat (see text for details).

• **Fuel screen.** The small fuel-filter screen in the carb can become dirty after several seasons of flying, and this can affect the engine's performance. Carefully remove the screen, flush it clean and replace it. For more details, see Rick Eyrich's article, "How To Maintain your Gas Carburetor," in the October 2000 issue of *Model Airplane News*.



The fuel-inlet filter screen inside your Walbro carb should be checked and cleaned after each flying season. A bit of workbench maintenance can help you avoid a lot of frustration at the field.

• **Fuel lines.** The rich and lean conditions of the fuel mixture depend on how much air is mixed with the fuel. If the engine begins to sag and overheat, then the mixture is getting too lean. A hole or cut in the fuel line can cause the mixture to lean out, so check the condition of your fuel system's plumbing. Start at the clunk, and work toward the fuel fitting. If you have an in-line fuel filter (a good idea), make sure it is tightly sealed. Also, gasoline is relatively cheap compared with glow fuel, so treat your engine to fresh fuel once in a while. If your gas can has been sitting in the garage all winter, dispose of the gas properly and mix up some new fuel.

Another possible—though uncommon—reason for the carb to stop pumping fuel is an air leak in the crankcase or cylinder. If your engine starts, runs briefly, then stops after you have squirted raw fuel or starter fluid into the carb, check whether any of the bolts that hold the cylinder to the case are loose. If you have installed a pressure tap in your case to run a smoke pump, make sure that it is properly sealed.

Jerry Nelson also distributes these German-made hardwood props from Fly-Tec. Available in up to 33-inch diameters, they are very nicely made.

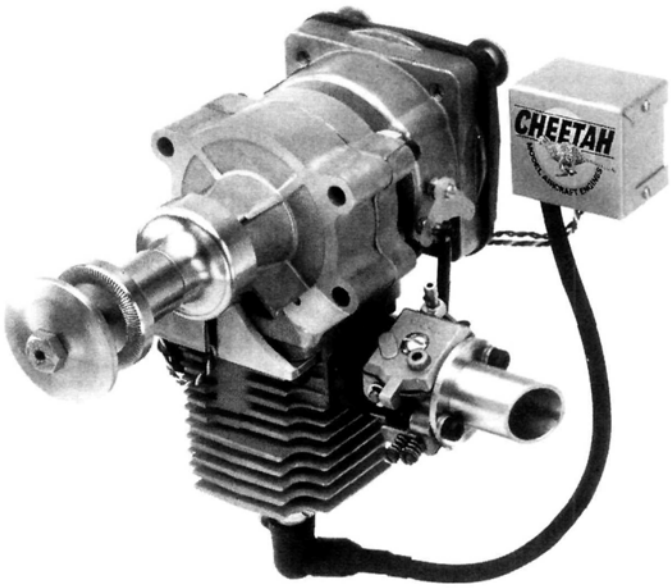
IGNITION PROBLEMS

The most likely problem here is a dirty, fouled spark plug. Check the plug's condition often, and make sure that the insulator isn't cracked. Make sure the grounding wire and kill switch operate properly and, if you have an electronic-ignition system, make sure its battery is properly connected and fully charged.

Make sure that the magneto and flywheel gap is correct. For a quick check of the gap distance, I use three layers of 100-grit sandpaper for a makeshift feeler gauge. This may seem crude, but it has served me well for years. Spark-plug gaps seem less critical, and they work well from anywhere between 0.020 to 0.035 inch. Check the coil and the spark-plug wire to see whether they have frayed or cracked. Look inside the spark-plug boot, and make sure that the coil that fits over the top of the plug fits properly and "snaps" into place. If the boot fits loosely, arcing and erratic engine operation will result.

CUSTOM LINKAGE

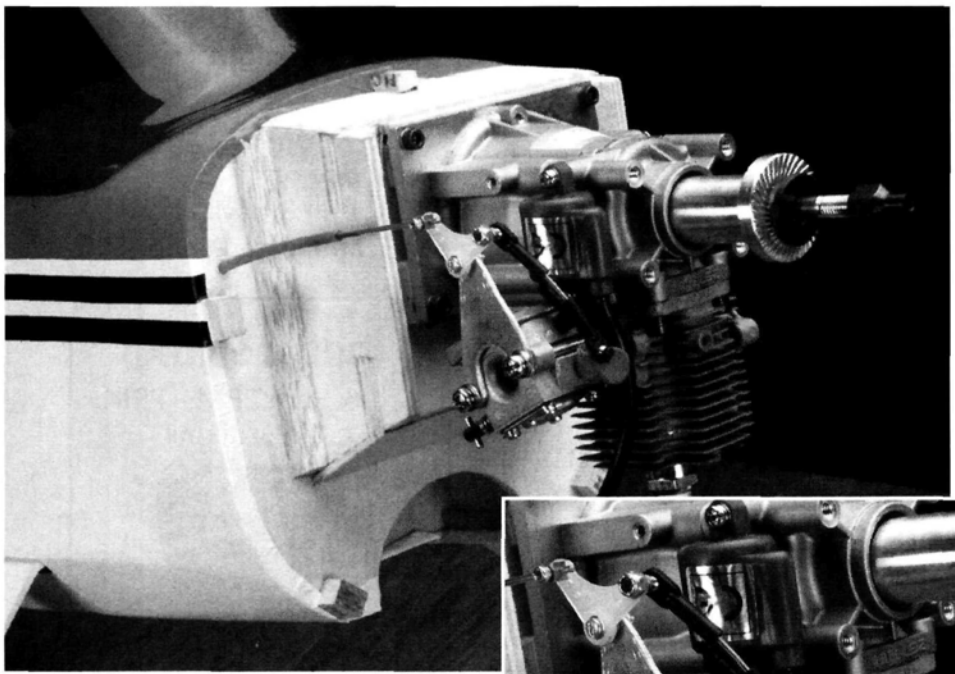
An ongoing challenge for gasoline-engine users is making and installing throttle linkage. Most Walbro carbs have the industrial web-shaped throttle arm, and this requires you to devise some sort of throttle-linkage attachment. To make this job easier, Bruce Hanson of B.H. Hanson* has made little, molded-plastic throttle-arm fittings that fit over the carb's butterfly pivot shaft. Inside the cap is a locking collar that fits over the Zenoah* G-23 pivot shaft and is locked into place with a setscrew. As you can see from the photos, a simple ball link is all that's needed to connect it to the rest of the linkage.



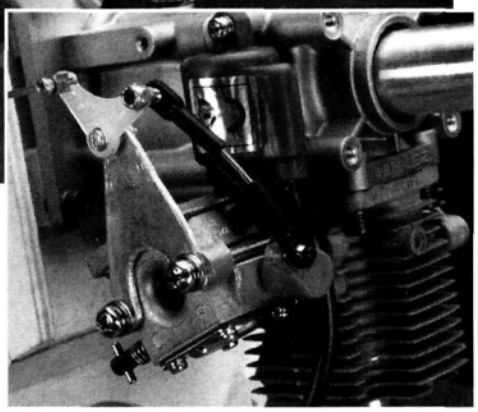
The Cheetah 25DX has an electronic ignition, so it requires a battery to power the ignition module. Make sure that your battery is connected properly and is fully charged.

In my inverted-engine setup, I used a simple, flat aluminum mounting bracket to support the throttle bellcrank; I attached the bracket to the engine with the carb-mounting bolts. The rest of the linkage is made from Rocket City* ball-link clevises, a 4-40 threaded rod and some plastic Sullivan* Nyrod. The hole in the cap's locking collar can easily be drilled out to fit other gasoline engines.

The G-23 that powers my Super Decathlon from Giantscaleplanes.com* is also from Bruce Hanson, who offers "hopped up" G-23s and other Zenoah engines. Stay tuned for more information on Bruce's engines.



Sometimes, you need to improvise to get your throttle linkage to work freely. Here, on my Zenoah G-23 GSP.com Super Decathlon, I attached a flat aluminum bracket to the carb to support the bellcrank.



A closer look at my B.H. Hanson G-23 shows the use of Bruce Hanson's throttle-arm cap to attach the linkage to the butterfly pivot shaft. Simple and easy to use, the Hanson caps can be used on other gasoline engines.

NEW PRODUCTS

Jerry Nelson of Nelson Hobby Specialties* has just added lightweight Pete's Pilots pilot figures and German-made Fly-Tec hardwood propellers to his catalog.

A popular maker of large-scale pilot figures in Europe, Pete's Pilots produces "sportsman" and "military" pilots in several sizes, including 1/6, 1/4, 29 percent, 1/3, 40 percent and 1/2 scale. All the pilots are molded from soft latex rubber and are hand-painted for you. These little guys also come with cool aviator sunglasses. Full-length figures are available in 1/4 and 1/3 scale, and all the pilots' heads are movable for more realistic poses.

Fly-Tec props are specially designed for large 2- and 4-stroke engines and range in size from 12 to 33 inches, with several "in between" diameters such as 15, 17, 19, 21 and 23 inches available as well. Made from selected hardwood and machined and fin-

ished to close tolerances, the props feature a sweptback LE and a pointed tip to help reduce prop noise. If you are interested in IMAA or IMAC flying, these competitively priced, high-thrust props are an economical alternative to the popular fiberglass and carbon-fiber props.

Call Jerry at (503) 629-5277 to order his catalog; Nelson Hobby Specialties has many useful items for modelers who "think big"!

Reid's Quality Model Products* sent me a photo of its new ⅓-scale Piper J-4E Cub Coupe; if you're looking for something that's

Scale pilot figures from 1/6 to ½ scale are now available from Nelson Hobby Specialties. These molded latex pilots are very light and come with aviator sunglasses.

Also available from Reid's Quality Model Products is a new plan for this ⅓-scale Piper J-4E Cub Coupe.

easy to fly but still a little different, this 1941 design should do the trick. Designed by Jim Messer, the Cub Coupe has a 144-inch span and almost 3,000 square inches of wing area. Available only as a plan, the Cub features full-length aluminum-tube spars; the rest of the airframe is traditional wood construction. A fiberglass cowl and wheel pants and metal landing gear are also available. Reid's plan costs $40 plus shipping, comes rolled and has 99 square feet of area! A semi-kit will be available in the future, so give Dave Reid a call at (315) 548-3779 for more information.

That's it for this month. If you have more tips and tricks for engine troubleshooting, email me at gerryy@airage.com or drop me a letter c/o *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

**Addresses are listed alphabetically in "Featured Manufacturers" on page 198.* +

PRODUCT WATCH

Latest product releases

INFORM YOUR CUSTOMERS! ***Model Airplane News*** **is interested in showing our readers your new products—here in Product News. If you'd like to see your products here, send us a clear photo and a press release that provides information about your product! We'll publish as many as space permits.**

Send your announcements to: Product News, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

SL MODEL

SL Flight Box

Who says you can't take it with you?

One of the biggest challenges a modeler faces in the field is trying to keep his tools, supplies and spare parts both orderly and accessible. That is why owning a good field box is a must. The SL Flight Box fits the bill nicely. The Flight Box basic kit incorporates twin fuel tanks (which can be linked or used independently), several storage compartments and removable legs with holders. SL also offers accessories for the Flight Box: an adjustable divider platform, a removable four-drawer toolbox and two retractable cradle arms. These can be purchased individually, or you can order your box as a complete set with all of the options included.

When assembled, the box has remarkably compact dimensions. With the legs stowed and the cradle arms retracted, the Flight Box measures approximately 19x11.75x13.5 inches (WxDxH). With the legs attached and the cradle arms extended, the box stands nearly 33 inches tall. Assembly requires basic tools: a drill, a screwdriver, an adjustable wrench and needle-nose pliers. All the hardware is included, and the procedure is straightforward, although the manual (translated from German) is rather sparse, and the measurements are metric—making drill bits of the appropriate sizes tough to come by. I recommend that you supplement it with the photos of the completed box from the SL Model website—this can cut your assembly time in half. SL Model tells me it has more detailed instructions in the works that should be available by the time you read this. When assembled, the box feels sturdy and stable, and its solvent-resistant plastic construction will be durable.

For the modeler who wants a field box that can carry the essentials in a compact, easily portable package but also wants the contents to be neat and accessible, the SL Flight Box is definitely worth consideration. The basic kit costs $122.95; the complete kit with box and all three accessories is $169.95 (plus S&H). *—Matt Boyd*

SL Model, P.O. Box 23727, Federal Way, WA 98093-0727; (253) 576-5353; fax (253) 942-3059; order@slmodel.com; www.slmodel.com.

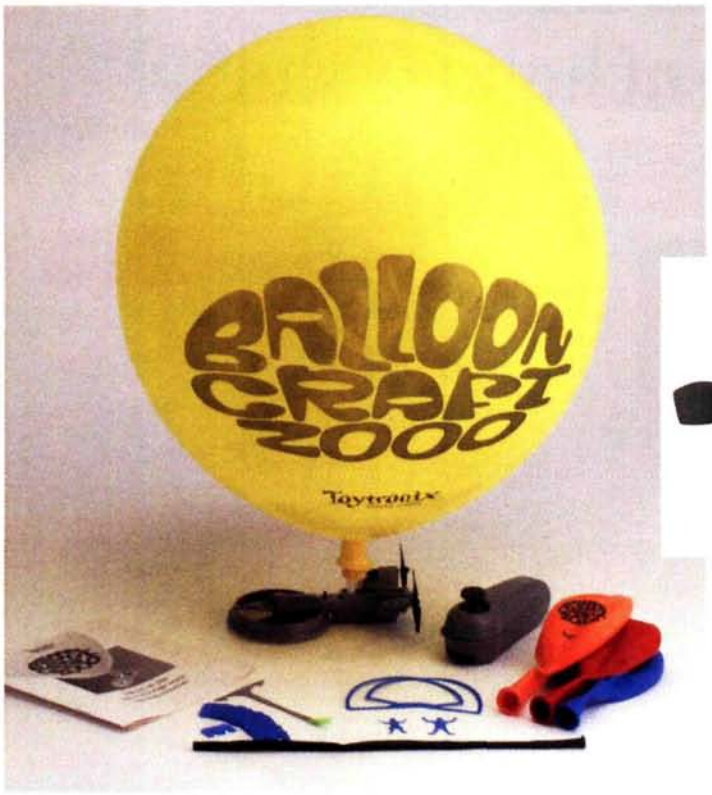
RPM CUSTOM ENGINEERED RC PRODUCTS

Hex Drivers

The right tools for the job

Every craftsman knows that the key to a successful project is to have the right tools. RPM is a staple in the RC car community, and it makes some fine-quality tools for use with airplanes as well. These hex (Allen) drivers were designed with the modeler in mind: they have impact and fuel-resistant handles, and high-grade, high-quality steel shafts and tips. The handles are color-coded to the specific size for easy identification, and the size is molded into the handle. The hex drivers come in nine sizes (standard and metric), and RPM sells them individually or in sets of four. The metric 4-piece set (no. 80770) includes 1.5, 2, 2.5 and 3mm drivers, plus a stand. Set no. 80690 includes .050-, 1/16- and 3/32-inch and 2.5mm ball drivers, with a stand. The 3/32-inch straight driver (no. 80670) is sold individually, and you can buy a stand separately (no. 80702) if you want to make your own set. The single drivers cost $8.95 each, the sets cost $34.95 each, and the stand costs $7.95. *—Matt Boyd*

RPM Custom Engineered RC Products, 14978 Sierra Bonita Ln., Chino, CA 91710; (909) 393-0366; fax (909) 393-0465; www.rpmproducts.com.



TOYTRONIX

BalloonCraft 2000

RC fun in your living room!

Enjoy RC fun from the comfort of your living room with the BalloonCraft 2000 by Toytronix. This innovative indoor flyer features a 17-inch helium balloon fastened to a small, gray drive unit that provides proportional steering and altitude control and 3-speed propulsion. The result is a maneuverable 3D micro flyer that's fun for beginners and experts alike.

Inside the box, you'll find the 30-gram BC2000 vehicle, a set of five, 17-inch latex balloons, a balloon connector, a fill hose, a fill nozzle, a set of 25 plastic ballast plates, a detachable plastic hook and two cutout plastic figures. Also required are a portable helium tank (these can be purchased wherever party supplies are sold), a standard 9V alkaline battery for the infrared controller and a standard AAA alkaline battery for vehicle power.

The BalloonCraft 2000 maneuvers with two bi-directional rear-facing propellers and a horizontally positioned propeller that generates lift. It has been designed so that the horizontal prop may spin while the unit rests on the floor. The controller sends an infrared signal to a receiver on the back of the drive unit. The range is more than adequate for an indoor flyer, but line of sight must be maintained for the controller to function.

The controller is quite intuitive and can easily be operated with one hand. The signal connection during startup can be a bit finicky, and because it is a lighter-than-air craft, it can be blown off course by the slightest air current (turn off your air conditioning before you begin!). But once you get the hang of maneuvering the BalloonCraft 2000, it's the most RC fun you can have without leaving your house! *—Gary Kolesar*

Toytronix LLC, 3370 N. Hayden Rd., #123-296, Scottsdale, AZ 85251; (866) 4RC-TOYS (472-8697); www.toytx.com.

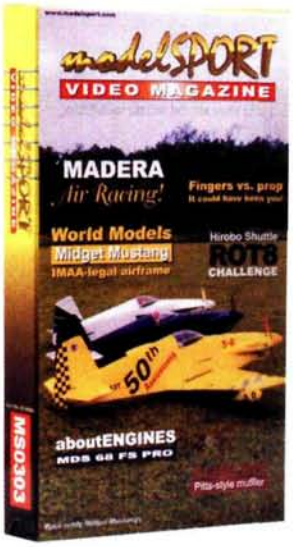
MODELSPORT VIDEO MAGAZINE

Video series

RC aviation goes video!

ModelSPORT offers a continuing series of videos that features events, products and how-to's on all aspects of the RC aviation hobby. Each installment is two hours long and full of informative tips and the latest news in the RC modeling world. Best of all, the videos allow you to experience the models in action—how they look, how they perform, how they sound. You can see the building tips performed right in front of you step by step, making it easy to duplicate the techniques in your own workshop.

The latest installment reports on the popular Hangar 9 IMAA-legal J-3 Piper Cub. There is a feature on Saito's beautiful FA-90TS 4-stroke flat-twin engine and a neat piece on Sullivan's Genesys—an onboard, voltage-regulated alternator. There is also an informative how-to on spray painting.



The production quality on these tapes is very good, so details are easy to pick up. Each tape includes a thoughtful VCR time index on the box and at the beginning of the recording, so you can fast-forward right to the feature you want. These tapes are a worthwhile addition to any modeler's library, and at $6.95 each, they're a great deal. Subscriptions and back issues are also available. *—Matt Boyd*

modelSPORT Video Magazine, P.O. Box 12557, Jacksonville, NC 28546; (910) 938-3371; fax (910) 989-1912; www.modelsport.com.

MULTIPLEX USA

Quick Charger

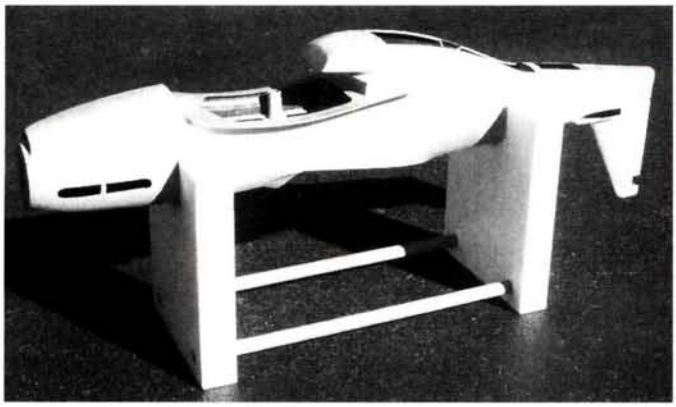
Versatile Power

The high-quality engineering of this 12V DC/DC, triple-output, auto-cutoff charger from Germany is apparent as soon as you examine its sturdy, compact case. Input is by means of cables with spring clips, and the three outputs can be used simultaneously: number 1 is for 6- to 10-cell transmitter or drive batteries (with a quick-charge current of 1000mAh and a maintenance, or trickle-charge of approximately 80mAh); 2 is for 4- to 7-cell receiver or drive batteries (with a charge current from 0.5 to 4 amps and a maintenance charge current of approximately 15 percent of that setting); 3 is for charging single-cell glow-plug batteries at a fixed rate of 1200mAh (this output is shaped like a glow plug so that the battery can be attached directly to it—very convenient!).

Outputs have red LEDs to indicate quick charging and green LEDs to indicate trickle-charging; to start the charge cycle, you simply press button. When charging is complete, the unit automatically switches to trickle-charge. The charge current can be monitored on an integral meter that is activated by a three-position switch.

This versatile, easy-to-use charger will be right at home in any model aviator's field box and it costs a reasonable $85. — *Jim Onorato*

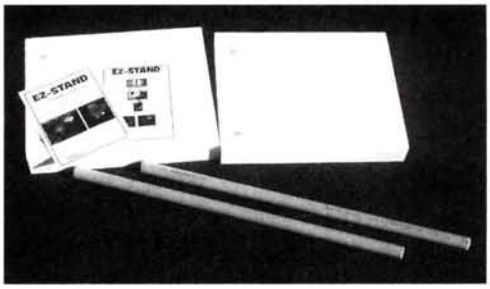
Multiplex USA, 560 Library St., San Fernando, CA 91340; (818) 838-6467; fax (818) 785-3946; www.multiplexrc.com.



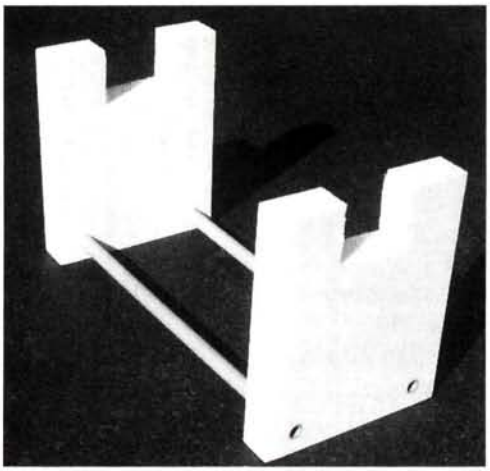
DYNAMIC BALSA & HOBBY SUPPLY

EZ-Stand Custom Aircraft Stand

Standing Tall



The EZ-Stand from Dynamic Balsa & Hobby Supply is a terrific addition to your workshop and great support equipment at the flying field. Available in three sizes, the largest consists of 16x20-inch foam blocks, which you cut to fit your fuselage, and two 35-inch, rugged PVC tubes. I assembled the unit in a few minutes and tested it with my Aerotech P-51, which my other stands have a hard time keeping upright. I measured the fuselage width, made a template of it, and then cut the foam with a hobby saw.



The foam works well and holds the P-51 securely. Best of all, it allows me to work on the fuselage in my workshop and can then be disassembled, taken to the field, reassembled and used to hold the fuselage when I want to attach the wings.

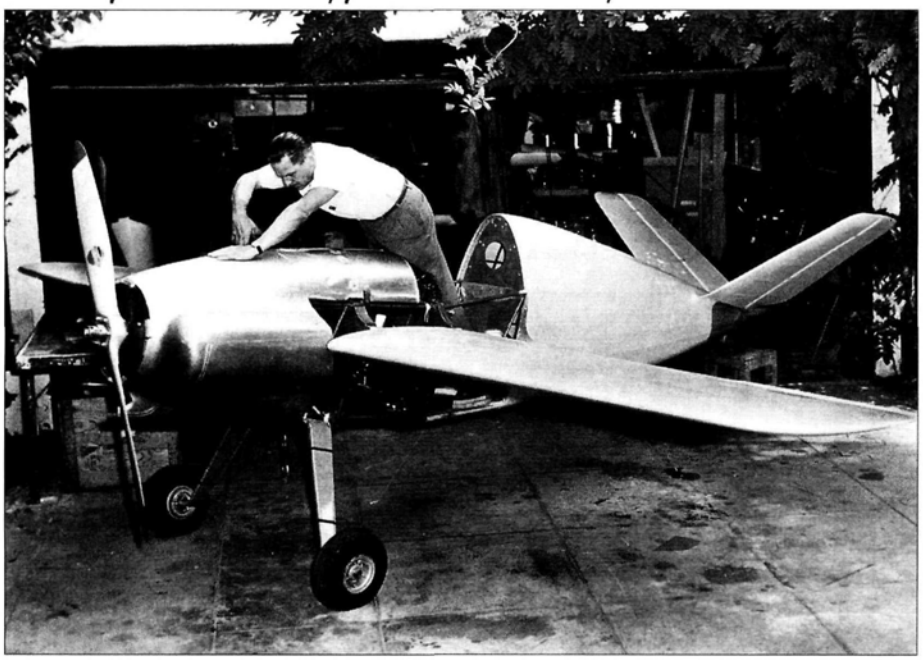
Extra foam blanks are available from Dynamic Balsa: 8x18 inches for the small stand; 12x16 inches for medium; and the largest (16x20 inches), which I used. For your special projects, Dynamic will make custom foam blocks and lengths of tubing. Prices: $8 (small), $14 (medium), $20 (large). — *George Leu*

Dynamic Balsa & Hobby Supply, P.O. Box 107, Leonore, IL 61332; (815) 856-2272; www.dbalsa.com.

NAME THAT PLANE

Can you identify this aircraft?

Send your answer to *Model Airplane News*, **Name that Plane Contest** (state issue in which plane appeared), **100 East Ridge, Ridgefield, CT 06877-4606 USA.**



The winner will be chosen, four weeks following publication, from correct answers received (delivered by U.S. mail) and will be awarded a free, one-year subscription to *Model Airplane News*. If already a subscriber, the winner will be given a free, one-year subscription extension.

Congratulations to Charles P. Stover of Ridgefield, CT, for correctly identifying the November 2000 mystery plane as a Fouga C.M. 170 R. The 170 R was the prototype that became the Magister series of jet trainers and light attack aircraft. The Fouga (and later Aerospatiale) C.M. 170s were some of the first dedicated jet trainers, designed from the beginning with a two-place cockpit. The first prototype of this plane flew in 1952, and variants remained in service in several countries well into the '90s. The standard version of the C.M. 170 Magister had a wingspan of 39 feet, 10 inches and a maximum speed of about 450mph. It had a range of 870 miles and could carry a variety of light armaments, including machine guns, rockets, bombs, or guided missiles.

MODEL AIRPLANE NEWS
HOW TO

by the Staff of Model Airplane News

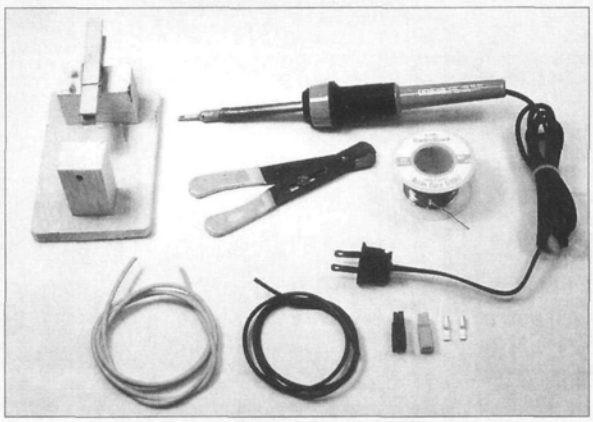
Solder universal connectors

More power, more convenience

Electrical connectors are among the most important items in electric-powered aircraft. If you don't replace the stock connectors that come with most batteries with universal connectors, you'll lose roughly ½ volt (read: performance) for every set of connectors in your airplane. Universal connectors also allow you to make and break electrical connections quickly and easily. Being able to disconnect your battery pack and remove it from your plane to charge it makes electrical power much more convenient and more fun, since you can install a charged pack and quickly get back into the air.

For several years, the popular Anderson Powerpole connector (called a "Sermos* connector") has been a favorite of the hobby industry. Because of the additional silver plating on its contact pin (which prolongs the connector's life), its design is well-suited to modeling applications.

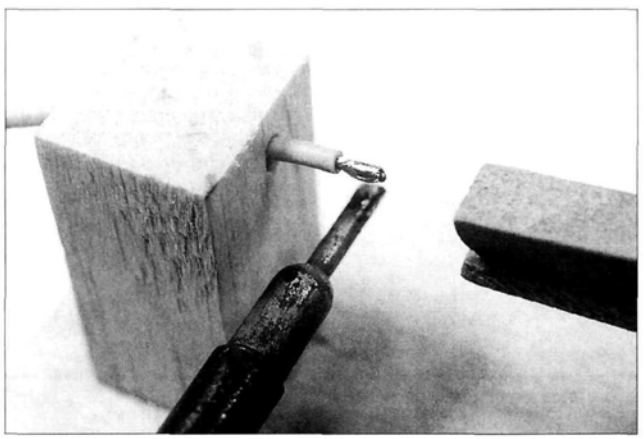
The connector consists of a silver-plated pin to which you attach your wire. The pin/wire assembly is then inserted into a molded-plastic housing until it snaps tight. Two such connector assemblies can be inserted into each other to form an electrical connection, and the interlocking housings snap together to hold the connection securely. This method of fitting these connectors to your electrical components can be a great timesaver at the field.



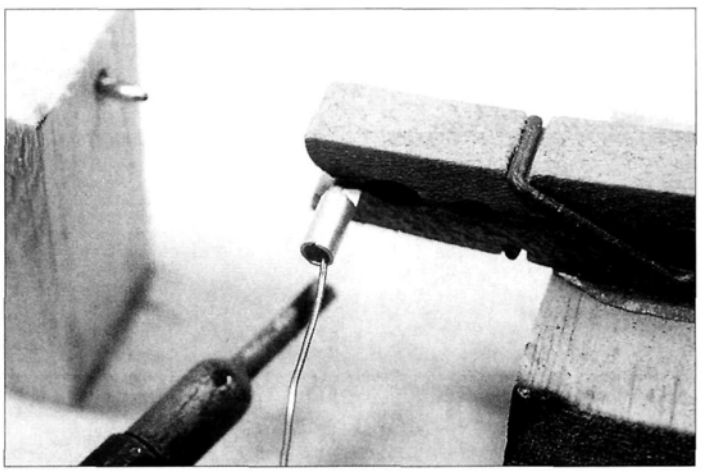
Professional crimping tools are available to assemble your connectors, but they cost approximately $150, and this is a substantial investment. For most modelers, soldering the connectors makes more sense, but you must use the proper technique.

As with any job, having the right tools is most important. My old Ungar iron still serves me well, but good modern units can be found at your local RadioShack, which also supplies accessories and solder. I prefer a thin solder because it melts faster—before the wire insulation begins to melt.

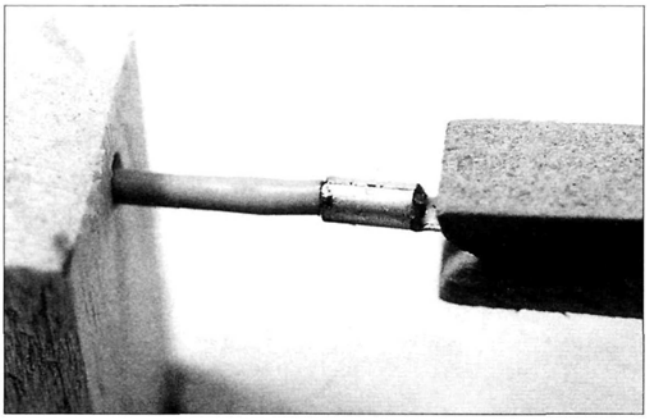
You must decide which wire gauge (diameter) best suits your application. This type of connector is generally used on Speed 400-size and larger motors. Speed 400s draw around 10 amps of current and can easily use a lightweight 16-gauge wire. Sport models with 05 to 25 electric motors drawing 15 to 30 amps need heavier, 14-gauge wire. All the larger motor systems and the various competition models that draw 30 amps or more require the use of 12-gauge wire. No. 16 wire is relatively easy to solder to a connector; 14-gauge requires a little extra care because its diameter takes up a large part of the pin's cup end. No. 12 wire presents the biggest challenge because it almost fills the cup end. Here's how to get the best results:



1 I built my own holding fixture out of some balsa-block scraps. One block has a hole drilled through it to accept up to 12-gauge wire, and the other has a clothespin glued to its top. First, strip about ¼ inch of insulation off the end of your wire. Twist the strands of the exposed wire together to prevent them from fraying. Insert the wire through the hole in the wood block, and heat the stripped end for a few seconds with the soldering iron. Then apply the solder—just enough to make the wire end look shiny.

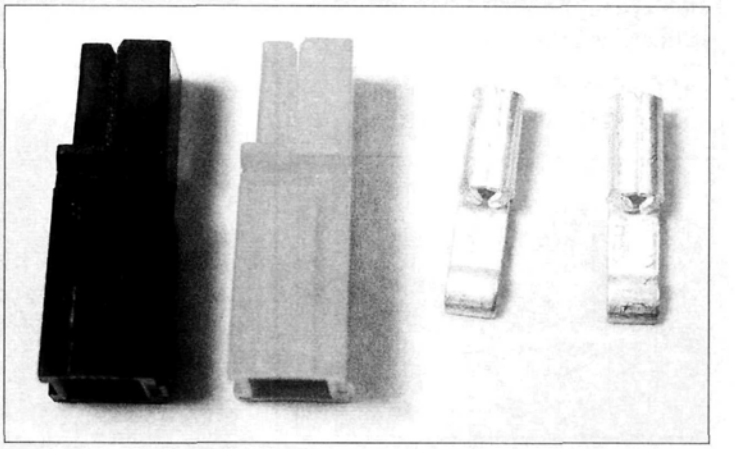


2 Clip the silver-plated connector pin in the clothespin. Insert a little solder into the pin's cup end, then heat the bottom of the connector pin with the iron until the solder starts to melt. As it melts, insert another inch or so of solder into the cup and then withdraw the heat. Do not apply so much solder that it runs out of the pin cup, or the connector won't snap into position later.



3 Turn the pin so that the cup faces the wire in the block, and move the wire forward until it touches the pin. Heat the lower side of the pin with the iron until the solder softens, then feed the wire forward into the pin cup with your other hand. Remove the heat, let everything cool for 10 to 15 seconds, then examine the solder connection. If you did it correctly, you won't have burned the wire insulation.

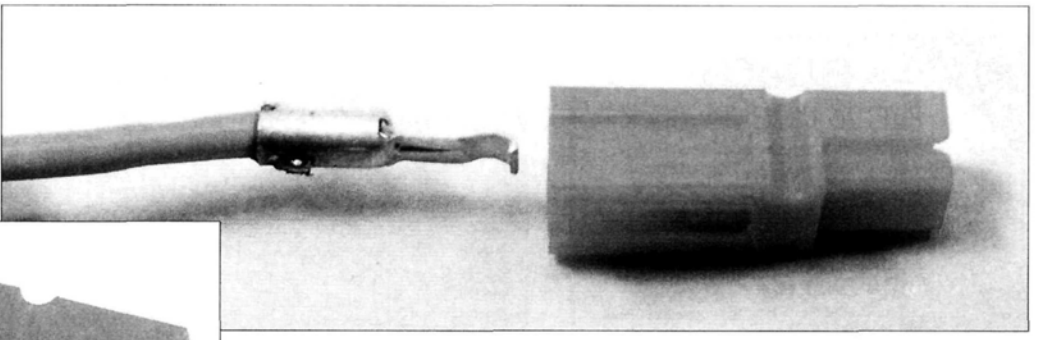
When using 12-gauge wire, be sure to twist the bare ends together as tightly as possible, and apply the solder sparingly, or the wire will never fit inside the pin cup. You will also have to heat the wire longer; make sure your iron is up to the task.

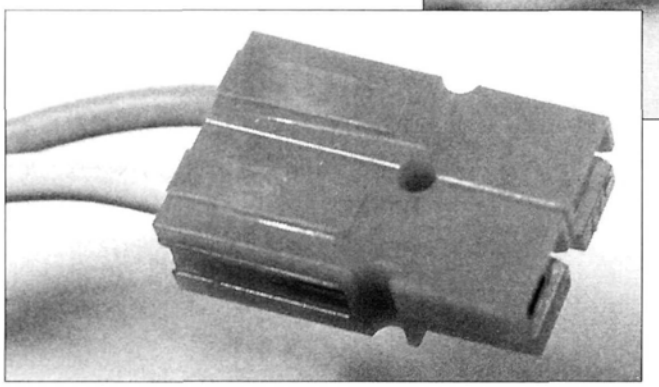


Housings

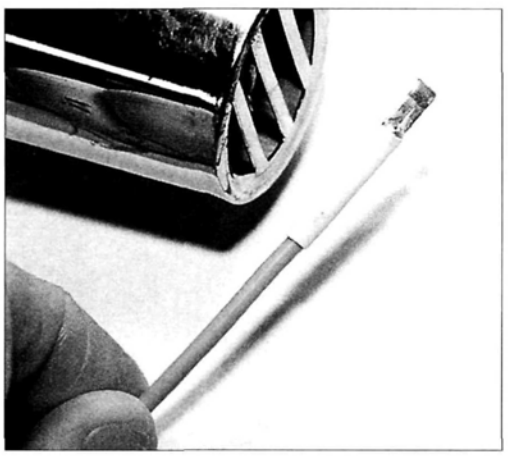
The plastic housings come in a variety of colors, so you may usefully color-code your connections. As well as the familiar red and black for positive and negative, you can also color-code specific devices; for example, use one pair of colors from the battery to the speed controller and another pair from the controller to the motor, and so on.

The standard connector housings are made of Lexan, which is quite strong but not impervious to many hydrocarbons. Contact with CA cement activator and contact cleaner can cause the housing to crumble in just a few days. Special hydrocarbon-resistant housings are available, so if you require this type, be sure to specify that.





4 The final step is to insert the connector pin into the molded-plastic housing. The instructions will tell you the correct orientation for the pin, though you probably won't require directions. Push the wire into the housing. Thin wire may buckle before the pin is seated. If that happens, use a very narrow screwdriver blade to push the back of the pin until you hear it snap into place; if it doesn't snap, it isn't in yet.



5 I have found that there's sometimes chafing where the wire and the housing meet, especially with narrow-gauge wire. Eventually, the insulation will be worn away and the wire will be exposed, so I like to cover an inch or so of the wire next to the pin joint with heat-shrink tubing. Shrink the tubing with a hair dryer set on maximum (never use your soldering iron!); then insert the pin/wire into the housing as usual.

Once you have completely assembled your connector, try to mate it with another connector assembly. You should hear a positive snapping as the two seat firmly. If you don't hear that sound, you've done something wrong, your electrical connection probably isn't solid, and your joint definitely isn't secure, so vibration and component shifting could easily dislodge it. It takes only a moment to make sure everything clicks together correctly, and it will save you frustration—and maybe a plane!—later on.

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Anchor Seal, 16 Riverside Ave., Danvers, MA 01923; (978) 774-5217; fax (978) 774-0638; www. anchorseal.com.

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Midwest Products, P.O. Box 564, Hobart, IN 46342-0564; (800) 348-3497 or (219) 942-1134; fax (219) 947-5703.

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Astro Flight News

Astro Flight Inc. Introduces five new and exciting products for the electric flyer: The new Mighty Micro 010 Brushless Motor for park flyers, a new Ducted Fan Brushless 05 Motor for the Kyosho T-33, FAI-035 and FAI-05 Planetary Motors for Sailplanes and two new surface mount digital speed controls.

The Mighty Micro is here!

Our new Mighty Micro Brushless 010 Motor #801 has arrived. The motor is one inch in diameter and one inch long and weighs only 35 grams with sensorless control. It spins an APC 6x2.8 prop at 9800 RPM while drawing only 2.5 amps from a six cell 350 mahr Nicad pack. Now you can fly for 5 minutes on Nicads, 10 minutes on Hydrides and one hour on lithium cells. The tiny On-Off Brushless control has Brakes and BEC. This system will work with 5 to 8 cell batteries. Perfect for models up to 10 oz.

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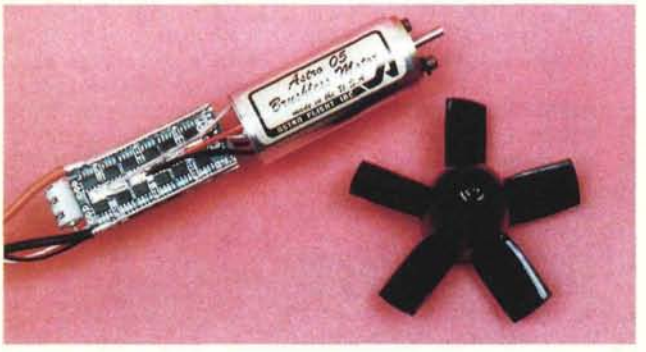

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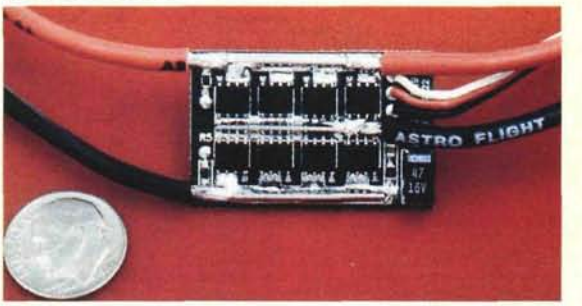
Our new 4.4:1 planetary gear box is now available for all Astro Cobalt 035, 05 and 15 motors. The FAI-035 with planetary gear box is perfect for 7 cell competition sailplanes. The FAI-05 with planetary gear box, shown here, is perfect for 10 cell sailplanes.

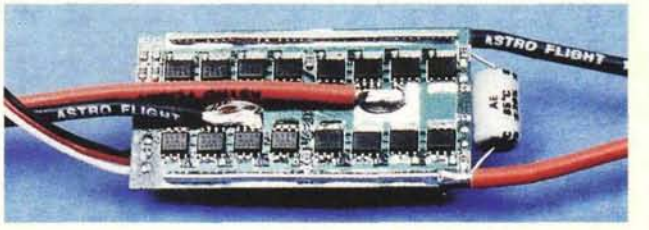
New Astro 215D Airplane Control

The new Astro 215D Speed control uses new surface mount technology for minimum size and maximum performance. The tiny 215D weighs only 8 grams and has Brakes and BEC. It handles up to 30 amps and 10 cells. Perfect for Astro Cobalt 035, 05 and 15 motors.



New 208D Reversing Control

The new 208D Reversing Control is designed for scale boats. It's 16 FET H-Bridge circuit gives you full power forward and reverse. The 208D weighs 1 oz and can handle 25 amps at 6 to 12 volts. It has a 2 amp BEC and a electronic current limit of 28 amps, so no fuses are needed. It was designed for tug boats and works great with 150 pound robots and electric powered blimps.



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MODEL AIRPLANE NEWS (ISSN 0026-7295, USPS 533-470) is published monthly by Air Age Inc., 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Periodical postage permit paid at Ridgefield, CT, and additional mailing offices.

SUBSCRIPTIONS. U.S. and Canada, call (800) 827-0323; elsewhere, call (815) 734-1116. Or set your Web browser to www.airage.com/subscribe.html. **U.S.**: $34.95 (one year), $55.95 (two years). **Canada**: $49.95 (one year), $87.95 (two years), inc. GST, reg. no. 13075 4872 RT. **Elsewhere**: $48.95 (one year), $83.95 (two years). Prepayment required; Visa, MC and AmEx accepted.

EDITORIAL. Send correspondence to Editors, *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. Email: man@airage.com. We welcome all editorial submissions, but assume no responsibility for loss/damage of unsolicited material. To authors, photographers and people featured in this magazine: all materials published in *Model Airplane News* become the exclusive property of Air Age Inc., unless prior arrangement is made in writing with the Publisher.

ADVERTISING. Send advertising materials to Advertising Dept., *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA; phone (203) 431-9000; fax (203) 431-3000.

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POSTMASTER. Please send Form 3579 to *Model Airplane News*, P.O. Box 428, Mount Morris, IL 61054 USA.

STATEMENT OF OWNERSHIP

Statement of Ownership, Management, and Circulation (Required by 39 U.S.C. 3685). 1. Title of Publication: MODEL AIRPLANE NEWS. 2. Publication no.: 533-470. 3. Date of Filing: September 29, 2000. 4. Frequency of Issue: Monthly. 5. Number of issues Published Annually: 12. 6. Annual Subscription Price: $34.95 7. Complete Mailing Address of Known Office of Publication: 100 East Ridge, Ridgefield, CT 06877-4606. 8. Complete Mailing Address of Headquarters or General Business Office of Publisher: Same. 9. Full Names and Complete Mailing Address of Publisher, Editor, and Managing Editor: Publisher: Louis V. DeFrancesco, 100 East Ridge, Ridgefield, CT 06877. Editor: Thomas Atwood, 100 East Ridge, Ridgefield, CT 06877-4606. Managing Editor: Debra Sharp, 100 East Ridge, Ridgefield, CT 06877-4606. 10. Owners: Grace V. DeFrancesco, Louis V. DeFrancesco, and Yvonne M. DeFrancesco, 100 East Ridge, Ridgefield, CT 06877-4606. 11. Known Bondholders, Mortgages, and Other Security Holders Owning or Holding 1 Percent or more of Total Amount of Bonds, Mortgages or Other Securities: None. 12. Does not apply. 13. Publication Name: MODEL AIRPLANE NEWS. 14. Issue Date for Circulation Data Below: December 2000. 15. Extent and Nature of Circulation: Average Number of Copies Each Issue During Preceding 12 Months: A. Total Number of Copies (Net Press Run): 111,077. B. Paid and/or Requested Circulation. (1) Paid/Requested Outside-County Mail Subscriptions Stated on Form 3541: 58,286 (2) 0 (3) Sales through dealers and carriers, street vendors and counter Sales: 22,131 (4) 0. C. Total Paid and/or Requested Circulation: 80,417. D. Free Distribution by Mail, Samples, Complimentary and Other Free: (1) 1,701 (2) 0 (3) 0. E. Free Distribution outside the Mail: 1,021. F. Total Free Distribution: 2,722. G. Total Distribution: 83,139. H. Copies Not Distributed 27,938. I. Total: 111,077. Percent Paid and/or Requested Circulation: 96.7%. Actual number of copies of single issue Published Nearest to Filing Date. A. Total Number of Copies (Net Press Run): 109,762. B. Paid and/or Requested Circulation. (1) Paid/Requested Outside-County Mail Subscriptions Stated on Form 3541: 59,376 (2) 0 (3) Sales through dealers and carriers, street vendors and counter Sales: 22,923 (4) 0. C. Total Paid and/or Requested Circulation: 82,299. D. Free Distribution by Mail, Samples, Complimentary and Other Free: (1) 1,632 (2) 0 (3) 0. E. Free Distribution Outside the Mail: 738. F. Total Free Distribution: 2,370. G. Total Distribution: 84,669. H. Copies Not Distributed 25,093. I. Total: 109,762. Percent Paid and/or Requested Circulation: 97.2% This statement of ownership will be printed in the January 2001 issue of this publication.

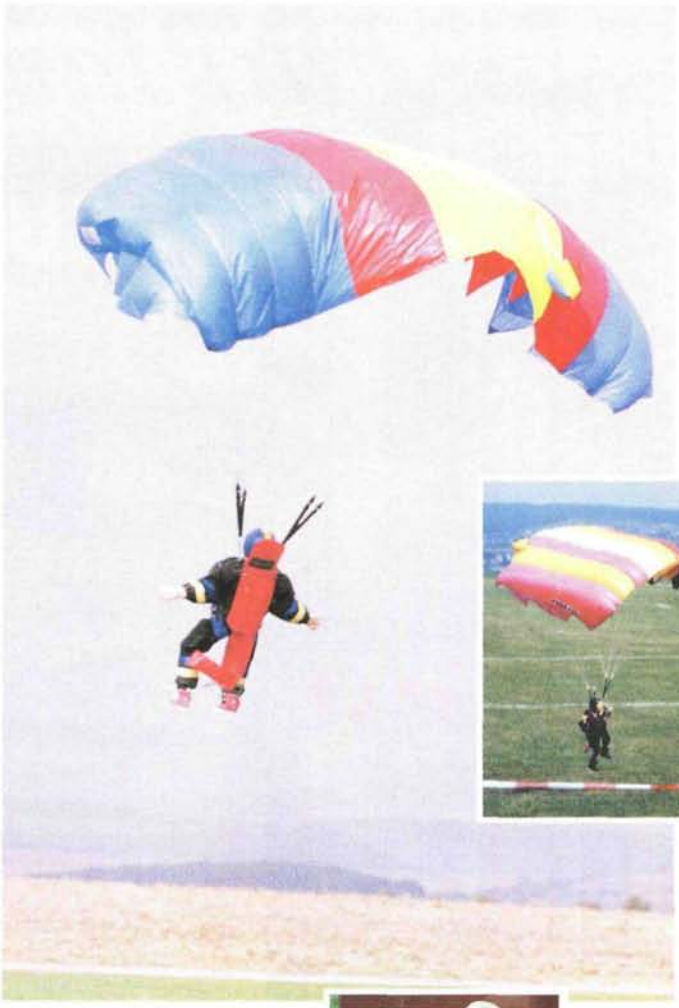
I certify that the statements made by me above are correct and complete.
Ned Bixler
Circulation Director

BY GUY REVEL

RC parachuters

Ever since Dr. Rogallo invented his "flying parachute," flight has no longer been limited to craft with big engines, solid wings and hinged control surfaces. High aspect ratio cloth "wings" produce enough lift for prolonged flights, and the time-honored, round parachute has been replaced by modern designs that provide controllable forward movement. This is recreated in miniature with RC precision parachute jumping.

I attended the latest Open German Championships and was impressed with the state of the art in RC parachuting. Most jumpers are about ¼ scale and have multi-cell sails that allow a high degree of control. In the last 20 years, these competitions have become very popular, and several aspects of RC parachuting make it appealing to beginners: the jumpers are durable and crashes are infrequent, so breakage is minimal. Learning to fly them is quite easy because of their relatively slow speeds and self-correcting behavior, though mastering advanced techniques takes time.



Directional control is provided by cords attached to the jumper's arms. Moving the arms alters the shape of the airfoil to increase or reduce drag and control speed and direction (just like with a full-size parachute).

With practice, pilots can direct their jumpers with remarkable precision. The target's center is only 1¼ inches in diameter!

HOW TO GET STARTED

Few things are required. The jumper's body is easily made as a simple plywood box, though most commercial models are fiberglass. You can buy a sail, or make it yourself, but this is somewhat more elaborate.

A 2-channel radio is enough to control flight, but most parachutists use a third servo to open the chute at the end of the free-fall.

A mission-ready jumper loaded up. Most are ¼ scale and weigh no more than 4 pounds; any .90 airplane could handle one.

Almost any plane can be converted into a jumper-carrier as long as it's large and powerful enough. Most jumpers weigh 3½ to 4 pounds, so any 90-size plane could carry one. In Germany, most jumper-carriers are simple sport planes with removable carrying devices. The Zenoah 62 is the power of choice, and an 80- to 100-inch-span plane will carry two jumpers to altitude. The jumpers' berth is typically under the fuselage or in side pods.

A jumper's structure is simple and easy to build. The body can be made as a plywood box, although store-bought jumpers are usually fiberglass. The double-hinged arms allow a very realistic range of motion.

FLYING A PARACHUTE

Control is the same as with a full-size parachute: pulling more or less on a control cord changes the sail airfoil on the corresponding side. The jumper's arms can be controlled by regular servos, but it's more realistic—and more elaborate—to use double-action arms (upper and lower arm pieces hinged at the elbow). This allows more throw and therefore more control, as long as the sail was designed for it.

Lowering one arm increases the sail's curve on that side, and the increase in drag initiates a turn. Lowering both arms provides braking and allows a vertical descent, but speed and control input are critical. The "aircraft" is prone to oscillate because the jumper acts as a pendulum.

The length of the free-fall is used to control the jumper's altitude and distance from the landing spot, and it depends on the wind. If the sail and extraction parachute have been correctly folded (the most critical step, as with full-size jumping), the sail pops open in a fraction of a second and the jumper begins the landing approach slightly downwind. If all goes to plan, the jumper hits the center of the target, which is a mere 1¼ inches in diameter, and earns the maximum score.

If you try RC parachuting, I'm sure you'll soon be hooked. It's easy enough for beginners to enjoy right away, yet precision parachuting is challenging enough for experienced pilots. It's a great way to enjoy RC with the entire family.

For information on RC parachuting in the U.S., check out the R/C Skydive USA website: www.rcparachutes.homepage.com. ✦